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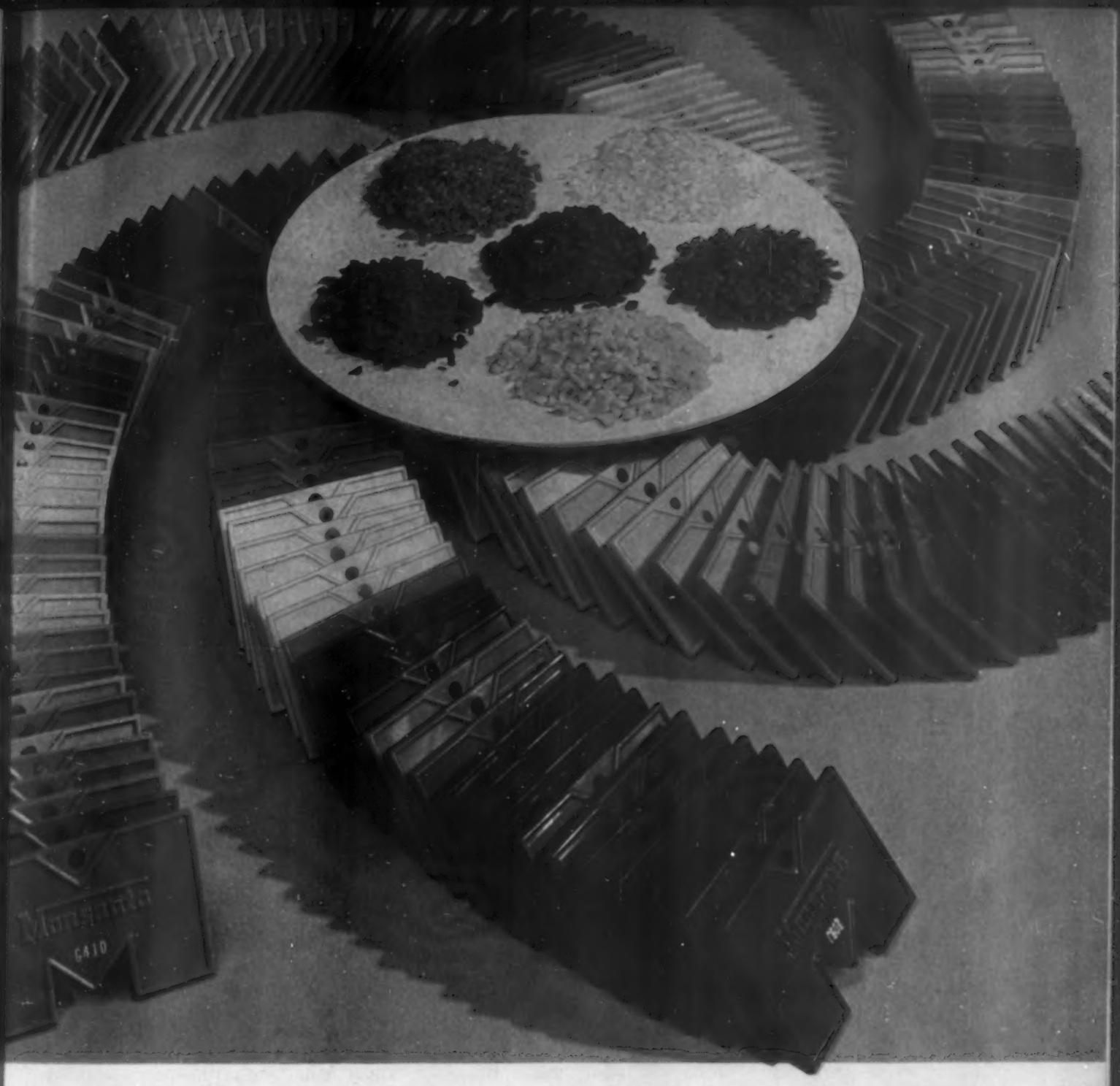

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OCTOBER 1–2–3

at Westchester Country Club, Rye, N. Y.

Practically everyone arrives Sunday afternoon, October 1st—maybe some golf—certainly for general tuning up.

At 9:00 A.M., Monday, October 2nd, a business meeting at the insistence of the Board of Directors—attend this or forever hold your peace.

Dinner Monday evening at 7:00 in the Sports Lounge followed by suitable (but proper) entertainment and a partial night's sleep. We eat at other times, too, but this is official.

Golf, Vocal Harmony, Good Fellowship liberally sprinkled throughout with Incidental Music.

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MODERN PLASTICS

SEPTEMBER 1939 VOLUME 17 NUMBER 1

SHEET PRODUCTION UNIT

by C. T. DRUMPELMANN, D. DOMIZI AND L. M. CURRIE*

THE INCREASING DEMANDS FOR SYNTHETIC resin sheet stock, particularly that of the thermoplastic type, has justified the development and commercial exploitation of the vinyl resins in this field with the result that (in addition to the cellulose nitrate, cellulose acetate, and acrylate types which have heretofore been used) vinyl sheets are now available to the fabricator. The uses for this type of product in the plastics industry are several and varied, but may be generally summarized to include articles such as advertising novelties, calendars, rules, radio dials and parts, book and pamphlet covers and bindings, drawing instruments, playing cards, toys, etc. The fabrication may involve any or all of such secondary forming operations as shearing, stamping, punching, swaging and drawing, hot forming to shape, machining in various ways, or printing in one or more colors.

The inherent characteristics of vinyl resin in the way of complete non-flammability, water, alcohol and general chemical resistance, freedom from warpage or distortion, unlimited color possibilities and high order of strength, make these sheets particularly adaptable to standard applications in the industry and justify the equipment engineering which has gone into the commercial development of the product. A standard planishing unit is comprised of (1) the laminating press, (2) loading and unloading mechanism, and (3) automatic control of platen temperature and pressure as hereafter described.

Before the first of these presses was installed, very close specifications were set up involving abnormally low press deflections, positive heating and cooling cycles, and production capacities. The rigidity of these specifications was prompted by the desire to produce a sheet which would more than satisfy exacting trade demands for uniformity of thickness, surface finish, and with high and uniform strength. Presses constructed to these specifications give very gratifying results, producing exceptionally uniform thickness, surface and excellent strength characteristics, to within $^1/_4$ in. of the edges of 22 in. by 52 in. sheets. Prevailing methods of sheet pressing in general require a 1 in. trim on the same size sheet. These improvements have been obtained for thicknesses of .003 in. to .750 in. in a wide range of flexibility, color, and surface finish. Results obtained after designing the equipment for producing these sheets to seemingly impossible quality specifications, warranted the adoption of this equipment as standard. As there are some interesting innovations in control equipment, heating and cooling means and loading mechanism, a description of the equipment will be of interest.

A ten-opening, 24 in. by 54 in. platen press is shown in the photograph on page 23. The press itself is of conventional two-ram design, having many features not generally found in this type of equipment. Extra heavy top and moving platens were designed to deflect a maximum of .0015 in. under a concentrated loading of approximately 300 tons. Before acceptance of the initial unit, tests showed deflections considerably below the .0015 in. Comparable deflections in average presses of this type under uniform loading, rather than concentrated loading, vary upward of .003 in. Holding deflections to less than .0015 in., coupled with care in constructing the platens, are fundamental factors in our ability to produce sheets of accurate dimension, and free from the common tendency of sheets to warp or shrink in subsequent use.

Since any inaccuracy in surfaces, or lack of parallelism between bottom and top surfaces of any platen, would produce inaccuracies in the finished sheet, all platens were ground. Following grinding, oil and emery finish was used to insure a mirror surface, with parallelism held within .001 inch.

Uniform Heating of Platens

All platens were drilled for steam heating and water cooling. Extreme accuracy in drilling was necessary to insure equal heat distribution to top and bottom surfaces. Likewise, the centers between ports were maintained accurately to give uniform heat distribution to either surface. In order to obtain still further uniformity in heating and cooling, reflected in uniform finish of the sheet, heating and cooling media were introduced at the center of the side on each platen and discharged at each end. Series flow, in place of parallel, was used in each half of the platen in order to insure

* Vinylite Division, National Carbon Co., Inc.

positive circulation of both heating and cooling media, and prevent dead spots or pockets.

The insulation between the platens adjacent to the head and ram platen was the subject of considerable investigation. The difficulty was insuring even temperatures (top and bottom) of the top and bottom openings. Normally, head and ram platens dissipate considerable heat which results in a temperature lag in the top of the top opening and the bottom of the bottom opening. In order to minimize this temperature differential extra platens were inserted above the top and below the bottom working platens. These are heated and cooled in the same manner as the other platens and no temperature differential can be measured between the two working surfaces of the top and bottom openings. Accordingly, heat distribution is uniform to sheets in all openings, assuring the production of uniform sheets within any press load.

Unique Loading Method

The loading and unloading of platen presses generally represents a time-consuming and usually a back-breaking operation. Automatic and semi-automatic loading devices are available for some of the larger laminating presses, but in general they are complicated and not readily applicable to our operations.

The loading device indicated in the photograph (between roller conveyor and press) reduces idle press time to a minimum. Average time for opening the press, removing processed sheets from ten openings, reloading press and starting the next pressing cycle, runs slightly under two minutes. This is a time saver, and gives more accurate heat control—eliminating necessity for holding a partially loaded press open for five to ten minutes for unloading and loading.

Due to its simplicity, ease of operation and quality advantages, we are describing this equipment. Sandwiches (alternate sheets and polishing plates) are made up on the conveyor shown in the photograph. These sandwiches are carried on steel plates whose sole purpose is to convey the material into and out of the press. Press platens are each equipped with ten flanged needle-bearing rollers, five on a side, for conveying the carrying plates into the press. The rollers for each opening are carried on brackets attached to the platen above, mounted so that the carrying plate clears the platen on which it will rest when the press closes.

The loading device consists of an elevator with two outboard cylinders and a steel frame carrying twenty sets of rollers for sandwich-carrying plates. The vertical spacing of rollers in the elevator is one-half that of the fully-opened press. The elevator, with alternate sets of rollers filled, is raised and the carrying plates with sandwiches are rolled into the press for processing. During the processing cycle, a second set of sandwiches is assembled and loaded on alternate sets of rollers and the elevator is raised so the empty rollers line up with press rollers. Upon opening the press, ten carrying plates are rolled back into the elevator, which is lowered or raised to line up the ten plates carrying unprocessed work. These are then loaded into the press, completing the unloading and loading cycle.

While the press load is being processed, the elevator is reloaded. The use of the short section of conveyor materially simplified the making of sandwiches. A carrying plate is withdrawn from the elevator and as one sandwich is broken down another is assembled. A planishing plate is removed from the finished sandwich, rolled over and placed on the end of the conveyor and an unpolished sheet of material placed upon it. Static charges, developed between conducting (planishing) plates and the insulating plastic layers, are discharged by ground wires in order to reduce trouble with dirt particles. This is repeated until the processed sandwich is broken down and the new one built up. Stops or gages are provided to insure accurate alignment of the planishing plates and sheets while building up the sandwich. The finished sandwich is rolled back on the elevator, which is lowered to index the next sandwich with the conveyor and the operation is repeated until the elevator has been refilled with unprocessed work. By lining up carrying plates, polishing plates and sheets, even distribution of pressure is obtained when each carrying plate is rolled to a stop at the end of the platens. This insures an evenness of polish which cannot be obtained from an unevenly loaded sandwich or press.

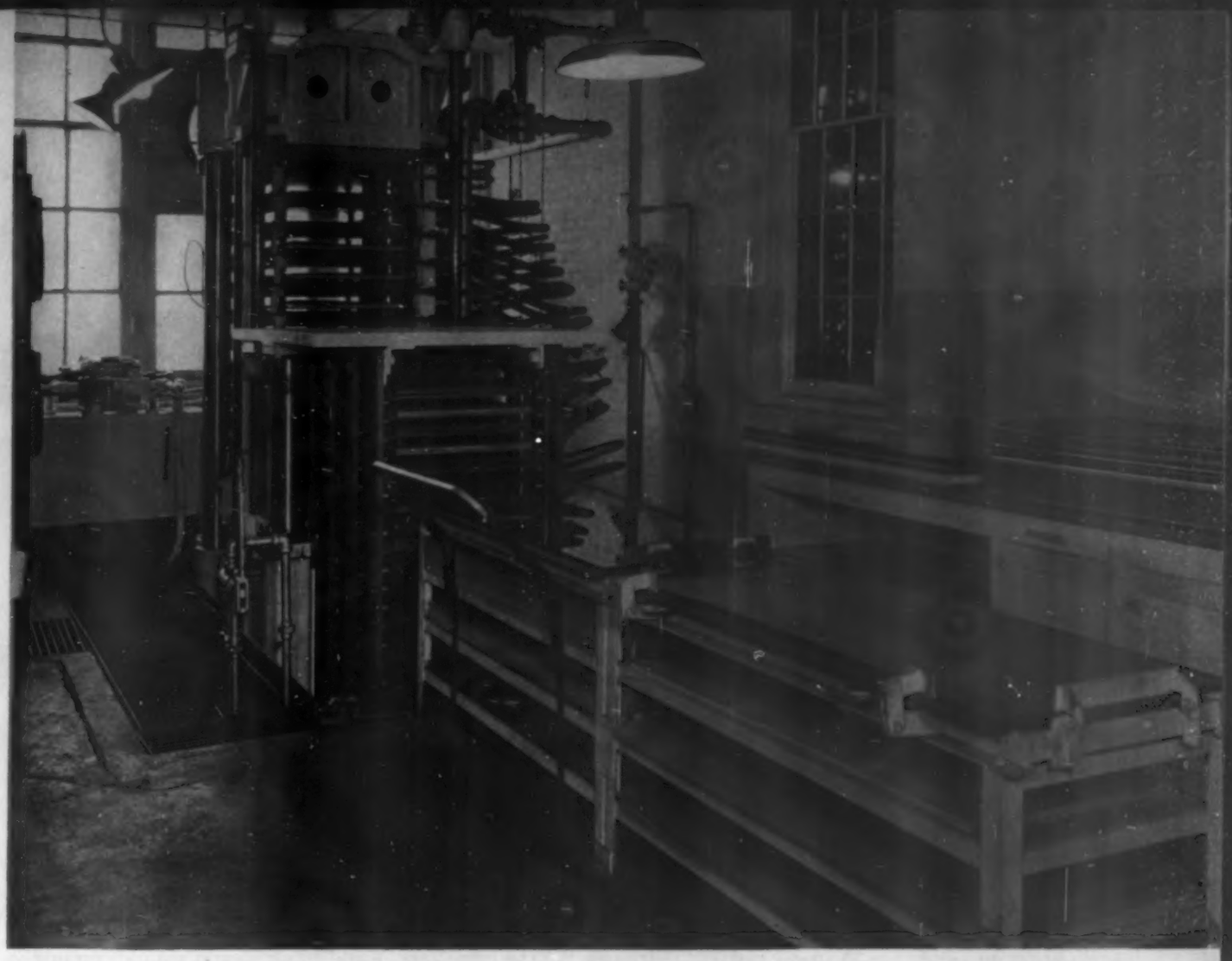
Defects, such as dents and scratches, in planishing plates are transferred to the plastic. With the system described above, there is a minimum of plate handling, resulting in maintaining proper finish on both plates and product. This unique method of handling plates and building sandwiches is a contributing factor in rapid production and high quality of sheets.

Temperature and Pressure Control

Many factors present themselves in the design of a temperature and pressure control. It is necessary to control both temperature and pressure accurately in relation to time in order to assure uniformity of product from one cycle to another. The temperature range is from 80 deg. F. to 350 deg. F. and hydraulic pressure varies from zero to press capacity.

Fundamentally, the operation of press polishing involves gradual application of hydraulic pressure until a desired maximum is reached. During this time, the platen temperature is gradually increased. A period of *soaking* follows, after which the platens are cooled under controlled hydraulic pressure and then released.

Variables involved are rate of pressure increase, rate of temperature increase, rate of cooling, maximum temperature, maximum pressure, duration of *soaking* period and overall cycle. It is essential that any cycle be duplicated at will. Ability to reproduce any cycle accurately insures a constancy of quality characteristics whenever it is necessary to rerun any particular type of sheet. To control these variations and permit duplication of cycles, the time-pressure and time-tem-



With consideration for the operator and efficiency in production, the sheet polishing press is loaded from an elevator which lifts the heavy loads to exact position. Roller bearings make it easy to insert and remove the heavy sheets along with their steel polishing plates. The press control panel is located on the wall at the left

perature controllers, shown in the control drawing, on page 66, were selected on the basis of efficiency of the instrument, combined with ease of cutting the controlling cam. The cams are 8 in. aluminum disks on which are imprinted the customary time-pressure and time-temperature charts. The cycle desired on each instrument is laid out, and cams readily cut.

A two-pen pressure and temperature recorder is used to make a permanent record of the cycles. Charts from this recorder are compared with the master cam by the inspection division prior to shipment of any stock, and become permanent records. Other control equipment consists of a four-cam cycle controller, diaphragm top control and pilot valves, water circulating pump and other miscellaneous items.

Each electrical circuit has an interrupting switch inserted to permit manual operation of controllers for experimental purposes. On production work, control cabinets are locked, pressure and temperature being controlled by the particular cams in use.

Platens are heated by steam at shop pressure and cooled by means of city water. Due to the variation in temperature of city water, it was necessary to design a system providing ample cooling capacity for summer conditions. Control is obtained automatically, the time-temperature controller throttling the steam inlet valve 8 during the heating cycle and controlling the water outlet valve 10 during the cooling cycle. This automatic control has removed the human element from all control operations. Controllers maintain temperatures and pressure within very narrow limits and provide exact duplication from cycle to cycle, insuring surprising uniformity in product.

Actuating bulbs for the controllers and recorders are located in the heart of the center platens. All platens are provided with locations for these bulbs and it was found that due to evenness of heating and cooling, the bulbs may be located in any platen with equal results.

Inlet and outlet manifolds, outside the platens, are designed with excess capacity to insure ample steam and cooling water supply. In switching from heating to cooling, steam is replaced with water. This presents no difficulties since valve 10 opens and allows a free discharge. When the change is (*Please turn to page 66*)

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Dramatic use of plastics for displays is illustrated by the Copper and Brass Association exhibit at the New York World's Fair. In the copper atom demonstration (Fig. 1), rings, 2 to 6 ft. in diameter, built from 3/4 in. Lucite rod, are surrounded by a transparent guard of 1/4 in. sheet Plexiglas. This material is used also for switch-yard, transformer station and high-tension towers in the rural electrification diorama (Fig. 2)

ADVERTISING DISPLAYS

by ROBERT PATTERSON MURRAY

The writer has been in various branches of the display business since 1927. After being connected for many years with Jenter Exhibits and Displays Co., a number of whose exhibits is illustrated here, he is now associated with The Displayers of New York City. (Editor's note)

IN A YOUNG AND FAST-GROWING INDUSTRY such as the exhibit and display business there is quite naturally a very prominent place for such versatile materials as plastics. The very nature of the business, which is mainly a job of showmanship, suggests the use of any materials which are new and lend themselves to dramatic treatment. Plastics certainly fill this need, but it is surprising to some to note that the majority of display manufacturers have hardly scratched the surface in the adaptation of these materials.

The term *Plastics* used generally in the following discussion refers to those materials which may readily be used and formed by hand, with the ordinary shop equipment regularly employed by all display men for single or limited quantity jobs. This means instances where the introduction of plastics will help dramatize a product, add materially to the effectiveness and artistic value of the display, solve difficulties of presentation in many cases not possible with other materials, reduce cost by simplifying construction, avoid breakage in handling, etc. The many apparent advantages of these materials have not been sufficiently made known to cause their general acceptance. There is such a conflicting variety of trade names, characteristics and prices that the average display man does not know one from the other. Some sort of broad educational program is necessary before plastics in general receive the wide acceptance for displays which they deserve. Current exhibits at the New York World's Fair should aid considerably in promoting their use.

The purpose of this article is to overcome to some extent this natural reluctance to experiment with strange unknown materials and, from the display man's viewpoint, describe some of their practical uses. It will not deal with large quantity production displays which use cast or molded units requiring extensive special equipment, as that is quite another story.

Among the more versatile and promising members of the plastics family are the new methyl methacrylate, or acrylic plastics. These are available in clear colorless transparent or colored transparent and translucent sheets and rods. They may easily be etched, carved and formed into various shapes. Machining, cementing, and polishing are fairly simple operations and the clear material transmits about 98 percent of the light. Thus edge-lighting and unusual effects are possible. The most frequently heard objection to this material among display men is that the cost is so high. This is true when compared to other materials such as plate glass which may serve equally well in some cases, but for special purposes there is no product which lends itself to decorative treatment so readily.

Last year the automobile show fairly blossomed with methyl methacrylate and other plastics. There were transparent railings which carried their own dramatic lighting effects, but which did not obscure the product

from any angle. One car manufacturer used a giant transparent replica of a shock absorber to show every phase of its operation. Another pointed out the oiling system used in their springs accurately reproducing a leaf spring in actual size from transparent acrylic. The important points were shown in color. Still another manufacturer showed a featured car on a turntable, and on each side of the car were full-size flat cut-out figures of 1/4 in. clear sheet methacrylate. We made the figures with sufficient carving in single form to indicate fashionable costumes, and they were edge-lighted from beneath the surface of the turntable so that they they stood out boldly from the background. Although they dramatically caught flashing reflections as they revolved, the figures did not interfere with close examination of any part of the car.

At the same show there were several applications of plastics used decoratively as edge-lighted fins and other structural parts of exhibits, but the above examples are cases where there were no "just as good" materials available. The new fluorescent lighting equipment has added considerably to the effectiveness of edge-lighting these acrylic plastics.

For the cosmetic industry the writer has made a cut-out hand of 1/4 in. sheet methacrylate with the fingernails carved deeply. Changing colors illuminated this hand from the wrist so that the nails picked up the edge lighting and demonstrated the various shades of nail polish. We also have worked out a demonstration for a lipstick manufacturer wherein the color of a beautiful girl's (edge-lighted methacrylate) lips changed to match the varying shades of complexion and hair of a blonde, brunette and redhead. This was done with the additional aid of rear-lighted transparencies in the background. Lipstick shades were matched accurately with several actual models of the three different types.

One New York World's Fair exhibit, showing transparent spheres floating in mid-air in front of a magazine, demonstrates a novel use of methacrylate. This is in reality a 1/4 in. sheet of the material with the spheres machined into one surface, then polished without buffing in a technique perfected for the job.

This was an experimental plate developed by the writer for a chemical company which wanted to dramatize the molecular structure of a sulphur atom, which is shown in Fig. 4. We used 12 plates in the final display and each plate carries certain parts of the atom which are arranged in circular formation both parallel and at right angles to the face of the plates. Each single globe is arranged in perfect mathematical relation to the others. The client's idea was to use glass globes supported on sticks to tell this story. The advantages of plastics here are apparent. Flashing lights on each side of the completed assembly give it animation and it is difficult to judge the depth of this atom without knowing its construction.

One of the most dramatic applications of plastics to date is the copper atom demonstration (Fig. 1). Contained in a copper-clad rotunda, it is a tribute to the creators of methyl methacrylate for this material has served the purpose so successfully. Formed of 3/4 in. diameter round rod of this plastic, this atom, exclusive of the base, is 6 ft. high. Details were worked out to the satisfaction of scientists. The rings representing the orbits in the molecular structure of the atom are of the correct diameter and are set at the correct angles in relation to the nucleus, which is a polished copper ball held in center by a 1/4 in. circular plate of the same plastic.

The electrons whirling around the nucleus are represented by tiny pea-lamps of low voltage which are screwed into miniature sockets set into the plastic rings. These electrons are numerically correct in their relation to each other and are operated by a 12 point flasher as the entire assembly slowly revolves. A guard of methyl methacrylate protects the exhibit without obstructing the view. Synchronized lighting and an explanatory

Fig. 3. A swirling ribbon of 1/4 in. Plexiglas supports actual specimens of copper ores in holes cut to receive them, in another Copper and Brass Association display. Symbolic copper planet is suspended by a Lucite rod. Preliminary model of a sulphur atom demonstration for the Texas Gulf Sulpher Co.'s exhibit (Fig. 4), uses many plates of Plexiglas to show theoretical molecular construction. Edge-lighting flashed on various sides give it remarkable animation

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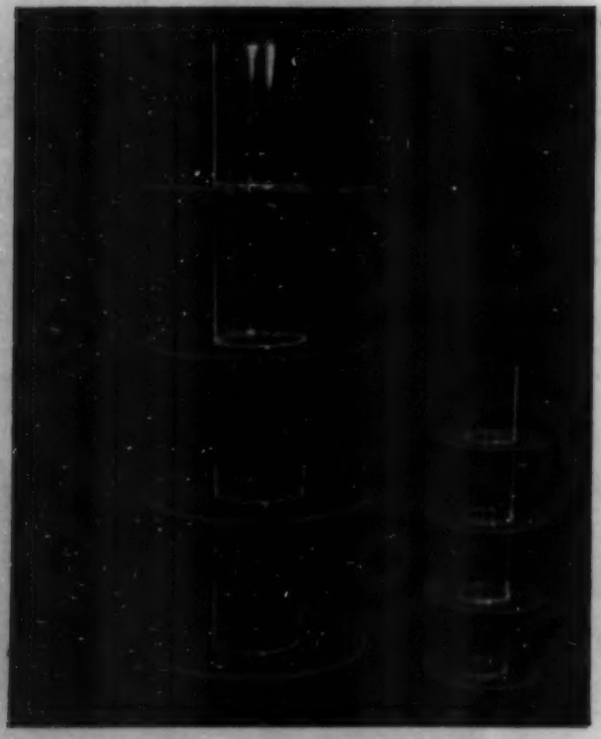

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"Under the sea" displays (Figs. 5 and 7), created for Saks Fifth Avenue by W. L. Stensgaard and Associates, Inc., feature Edge-Glow, a translucent cellulose acetate by Monsanto. It has the property of glowing brilliantly under light wherever its surface is cut or carved

monologue are combined to complete the dramatic effect. The result is a thing of beauty while it makes possible an educational demonstration surpassing any previous efforts in simplicity. It answered the questions which are usually fired at the *never-been-done-before* ideas. "Its a swell idea if it will work." "Even if you could build it, how could you handle it?" "How in the world can you wire such a thing." "What's going to hold it together?" A sample ring was made in full size to prove the exhibit was possible.

First, a groove was cut in the length of the round rod to form a channel for the wiring, using a dado on the circular saw. Then the rings were shaped around forms of plywood with the groove on the inside. The material was heated in water in an open trough of galvanized iron, brought to boiling point with several blowtorches. When bent to shape the joints were held together under pressure with wedges and wood clamps. To cement the joints we used liquid methyl methacrylate, painted on with a brush. This softens the material slightly and must be kept in clamps for about 8 hrs. or more. We experienced a few fractured joints in handling but they were easily repaired in the same manner. When all the rings were completed they were assembled using lengths of the same plastic rods as supports. Some of these also had grooves to carry the wiring from one ring to another. As this is a discussion of plastics we will not deal with wiring or mechanical details. After being wired, the groove was closed with strips of $^1/_{16}$ in. methyl methacrylate cemented in place.

Joints were scraped clean and the whole assembly finished with fine sandpaper to partially conceal the wiring and give it a uniform appearance. A circular plate of $^1/_4$ in. clear acrylic was cut to fit snugly inside the 2 ft. center ring. In the center of the plate we cut a hole slightly smaller than the diameter of the copper ball. This acrylic plate resting on the nucleus helps support the electron orbits.

In the same exhibit, it was left to our imagination to find a way to support heavy samples of actual copper ore in a spiral arrangement from floor to ceiling of a showcase. Fig. 3 shows how holes were cut in $^1/_4$ in. methyl methacrylate to receive the ores, then the plate bent to shape and all edges polished. The symbolic copper sphere and ring were suspended by a rod of the same material. Note that no fastenings of any kind are visible and the specimens may be examined without the detraction of usual shelves, brackets, etc. The methacrylate adds materially to the richness of the display.

There are many uses for plastics also in models and dioramas besides usual windows, doors, etc. The copper exhibit features a model open-cut surface mine which because of the design was not enclosed in a showcase. A guard railing of curved sheets of methyl methacrylate protects it from the souvenir hunting public. All the explanatory copy plates in this exhibit are of acrylic plastic with lettering either painted or cut out and applied. The advantages of this are obvious. The $^1/_8$ in. plates are flexible and unbreakable and were drilled and screwed to flat or curved surfaces where desired. Glass

would have been much more difficult if not impossible to use. The saving in labor in this connection alone was no small item to be considered.

In the rural electrification diorama (Fig. 2) there are some novel applications. The high-tension towers shown, expensive to construct in three-dimensional form, are photographs of an actual model. The photos were enlarged to the desired size and mounted on flat 1/8 in. sheets of methacrylate. They were then cut on the outline of the towers, and the spaces between the structural members stripped of the photograph with a sharp knife, leaving the clear plastic in these areas. The switch-yard and transformer stations were treated in somewhat the same manner, using painted structural lines instead of the photographs. These were executed in several planes so that when the plastic sheets were assembled with space between, the effect was remarkably three-dimensional. Applications of this kind save a great deal of money in labor, as accurate scale models of such things are very expensive.

In a futuristic demonstration of the advantages of copper we used the same plastic for cut out and carved parts of the display representing a scientist surrounded by his laboratory of equipment amid visions of future developments. These sparkling transparent cut-out shapes were easily made in methacrylate with band saw and jig-saw, edges scraped and polished, and cemented in the final assembly.

Methyl methacrylate was chosen in most of these instances because there is less warping to contend with and it is permanently colorless. Either wood or metal-cutting band-saws may be used and a wide toothed jig-saw blade is best. There are some on the market especially made for plastics. Edges may be sanded by hand or machine and scraped clean with a sharp steel edge. Sheets must be protected until final assembly with paper fastened to both sides with rubber cement as the material scratches easily. Edges may be polished on a buffing wheel but the operator must be experienced as the material overheats easily. A better method is to apply the buffing compound with a soft cloth tacked over a block of wood, the plastic being held in a padded vise or clamp. Ordinary lava soap makes a good compound if the regular material is not available. Scratches may be removed by sanding until the scratch is eliminated, then polishing with lacquer rubbing compound. Some auto body polishes work well also. This may leave a slight waviness in the surface of the sheet but in most cases it will not be serious. The best way is to take extra precautions to avoid scratching.

Carving may be done by placing the transparent sheet over the drawing to be reproduced, and doing the work with one of the popular electric hand grinders used for pattern work, etc. A wide assortment of cutters and wheels are available. This type of work requires an experienced man as one careless move may ruin an expensive piece. Sculptors and wood-carvers are usually employed. Goggles must be used to protect the eyes from flying particles. The surface of the material must not be rubbed but should be dusted (*Please turn to page 60*)

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Display fixtures (Fig. 6) clearly show the Edge-Glow effect while the striking Christmas display piece (Fig. 8) further illustrates the brilliance of this new display material. Both were produced by Stensgaard. (Color plates were made available through the Plastics Division of Monsanto Chemical Company)

Radioear "Masterpiece" consists of battery case with intensifier, microphone and either ear or bone conduction receiver (left), compactly molded of Durez by Rathbun Molding Corp. Below—Interior construction of case reveals ribbing for strength and segregation of batteries. Four small brass inserts attach the vital tone-carrying device to the microphone

NOW YOU CAN HEAR

by C. R. SIMMONS*

EIGHTEEN PERCENT DOESN'T SOUND LIKE very much when you're talking about discounts, but when you say more than 15,000,000 it becomes a figure of seemingly enormous magnitude. Or, put it another way: if all the inhabitants of New York City, of Chicago, of Philadelphia, of Detroit and of Los Angeles were not laid end to end but were partly deaf, you'd quickly realize what a tremendous number of folks in the United States have defective hearing.

Developing hearing aids has been a problem since the beginning of man and the earliest recorded efforts reveal a megaphone made from the horn of animals by the Egyptians about 900 B.C. More than 600 years later Alexander the Great gave further proof of his worthiness to title by making a slight improvement. Some 1600 years passed before history records the use of a fan held in the teeth as a definite aid to hearing. This, incidentally, is the first known bone conduction instrument. In 1673 came the ear trumpet, a familiar unit to many of us. Between 1700 and 1880 many refinements and modifications appeared in these trumpets. But in 1876 came the telephone, the first electrical hearing aid. Since then the original telephone principle has been refined until today we have such units as the Radioear, consisting of a small battery holder, microphone and receiver, as illustrated.

Ever since plastics were discovered they have performed importantly in the development of these hearing aids that mean so much to those of us who need them. Goodyear's vulcanizing process in 1839 was adapted by the ear trumpet manufacturers to give their product more convenient, better fitting shapes. The story of plastics and the telephone manufacturers is an old one, as familiar as plastics in the electrical field. It's only logical that today's hearing aids should turn to plastics as one material ideally suited to their requirements.

The newest development in this field, E. A. Myers & Son's Radioear "Masterpiece," (*Please turn to page 64*)

* Durez Plastics and Chemicals, Inc.

WOVEN WOOD LAMINATE

PANELS MADE WITH PERMANENTLY FINISHED wood veneer, fabricated by treating skillfully woven strips with plastics, are now available to furniture designers, interior decorators, architects, and others interested in a finishing material which combines durability with beauty. The veneer is coated and impregnated with resin varnishes, and a remarkable toughness is the result. After cutting the veneer into strips of the desired width, close, accurate weaving is possible. But further treatment is necessary to fuse the woven sheets into satin-surfaced, durable panels that can be cut and worked with in practical application.

In order to produce such panels, the woven sheets of impregnated wood veneer are cut to the desired sizes and are bonded to laminated material under heat and pressure. The desired tough, resilient and smooth surfaces, capable of resisting considerable heat, result.

The finished panels, in thicknesses of $^{3}/_{64}$ or 0.020 in., have a variety of applications. Mounted on plywood or other solid backing, this decorative material constitutes a fine new finish for such objects as desks, card tables, cabinets, bars, walls and ceilings. Unaffected by moisture, alcohol, finger-nail polish and most common acids, the material is also resistant to cigaret burns. In the 0.020 in. thickness, it is surprisingly flexible and can be stitched, stapled, and cut with ordinary shears, like a piece of leather. In either thickness it can be formed, cut, and applied by conventional woodworking methods.

A panel of the material, after the final treatment, has a surface almost as smooth as glass and a pattern that looks like a fine, highly polished mosaic. Numerous effects are available through the combination, in weaving, of various light and dark woods. Panels are usually made with light or dark red mahogany; avodire, a golden-shaded wood imported from the Ivory Coast of Africa; birch, either red or white; New England maple; and walnut.

On either the $^{3}/_{64}$-in. or 0.020-in. thickness, the standard sizes of the panels are 36 by 72 in., 36 in. square, and 30 in. square. All sheets are shipped with the unfinished side sanded, ready for application to the desired backing. Three standard weave widths—2-in., 3-in., and 6-in. strips—are recommended for ordinary applications, but for small products where narrower weaves are indicated, special widths are available. Designs or silhouettes on a panel, made by variations in the weave or simply by bonding-in a wooden cut-out figure in the final heat and pressure treatment, are available.

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These interesting new uses of Parkwood—Textolite are indicated in (Fig. 1) a utility table or portable bar introduced by Mary Ryan; (Fig. 2) the cocktail lounge table made by Kuhn and Mundes; and (Fig. 3) the extra-leaf dinette table by Hampton Specialty Products Co. This woven laminated plastic is a new product developed by the Parkwood Corp. in conjunction with General Electric's Plastic Department

PHOTO, COURTESY METRO-GOLDWYN-MAYER 1

One thousand crystal-clear Catalin pendants dangle from jeweled strips on a costume by Adrian (Fig. 1), worn by one of the chorus girls in M-G-M's "The Great Ziegfeld." In the same production, Virginia Bruce (Fig. 2) appears in a gleaming head-dress built up with rows of round and pear-shaped transparent cast resin ornaments. The high neckline of a simple frock, worn by Loretta Young in the 20th Century Fox film, "Wife, Husband and Friend" (Fig. 3), forms a soft background for an intricate necklace of cast resin and metal combined. Designed by Joseff, these "movie" plastics were fabricated in his workshop

JOSEFF, OF HOLLYWOOD

by EVE MAIN

UNTIL SOME SIX years ago, desiging jewelry was just a hobby with Joseff, of Hollywood. Today, about 90 percent of all the spectacular jewelry worn by actors and actresses in the movies comes from his studio and workshop. Elaborate headdresses, jewel-studded tiaras, ornate crowns, fabulous necklaces, rings, bracelets, earrings and trinkets galore, bearing the Joseff trademark, are fashioned by skilled craftsmen who have come to Hollywood from all parts of the world. He has been among the first to elevate the humble plastic materials to a high plane where they mingle freely and even compete with far more precious substances.

It all came about like this: Advertising was Joseff's vocation and he worked at it until the bottom dropped out of practically everything way back in the early "30's," letting him down—hard. Now jewelry is the first thing that falls off during a depression and the last thing to pick as a business especially in lean times. But Joseff had been dabbling with jewelry design in his spare time and felt quite confident that he could make a go of it once he got started. His designs were fresh and original—so original, in fact, that of the drawings sent to conventional jewelers for consideration, about 50 percent came back with the report that they were impractical to make.

Joseff didn't agree. He went ahead and built rough models of paste, refining the design as he went along, demonstrating to his own satisfaction that not only were they entirely practical to make, but eminently desirable for adornment as well. The next major step was to find a market for their use. This wasn't so simple. For a year and half, Joseff haunted motion picture studios with his samples finally breaking in with a rhinestone bracelet and four buttons.

From then on it has been more or less a matter of keeping up with the demand. Rush orders for jewelry to be worn in productions already under way are given one day and wanted the next, or almost that fast. Often when a little more time is allowed, original pieces designed by Joseff and executed in his studio are selected first and then costumes are built around them. Extensive research on jewelry throughout the ages, makes

2 PHOTO, COURTESY METRO-GOLDWYN-MAYER

3 PHOTO, COURTESY 20TH CENTURY FOX

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possible authentic interpretations of pieces destined to appear in period motion picture films.

Up to now, between five and six thousand unusual pieces have been collected in Joseff's personal museum, for it is his policy to rent his creations rather than sell them outright. After serving their term in the movies, back they come, are properly labeled and allotted a place among their predecessors. If the studios or actresses want any particular pieces for keeps, he will make duplicates, but it is understood that the originals are his.

About a year and a half ago a commercial line was developed to satisfy high style retail establishments which had been angling for Joseff-designed jewelry to feature in their stores ever since his first efforts appeared in films. Some of the pieces are replicas of those worn by the stars; others are made especially for commercial sale. In the comparatively short space of time that his creations have been available for general sale, Joseff has entered on his books an imposing list of better retail outlets all over the world. And without showing a sample line to any one of them. Buyers in this country trek to the coast to make their selections. Or order and pay for one of the books that Joseff has compiled, filled with photographs of movie queens wearing his trinkets.

Joseff's staff is manned by 35 to 70 people, depending on the season, and these are for the most part trained craftsmen. His workshop is equipped to handle wood, glass, tin, platinum, gold, silver and precious stones. And almost from the beginning, plastics have shared honors with these more conventional materials because, says Joseff: "I have a feeling for plastics. I like them. It isn't just that they are tractable to work with, but we have found that when properly handled, they have all the lasting beauty, refinement and stability of any material associated with jewelry fabrication. They are so adaptable that with them it is possible to interpret any material or shape desired."

His keen appreciation of the versatility and adaptability of plastics is evidenced by the jobs he has given them to do. There is the head-dress, for example, worn by Virginia Bruce in M-G-M's "The Great Ziegfeld," which is highlighted with pear-shaped ornaments machined from clear, transparent cast resin. The total weight of the huge piece with its plastic embellishment is fourteen pounds. The same effect, achieved by decorating with any conventional material would mean a considerable increase in weight, very likely making it awkward and uncomfortable to wear during the filming of the scene in which it appears.

A costume, designed by Adrian and worn by one of the chorus girls in the same production, consists principally of 1000 pear-shaped crystal clear cast resin dangles made in Joseff's workshop. The cost of this glorified outfit was approximately $2000 for a scene of about sixty seconds duration.

Massive necklaces with several strands of big beads are not nearly as heavy as they look since the beads are fashioned from gem-like cast resin. Crowns, scepters, staff handles and a galaxy of other pieces and trim keep plastics busy in the movie world.

Joseff's latest experiments with plastics for his commercial line have to do with injection molding cellulose acetate. It is true that jewelry and trinkets have been made of this material and by this method for sometime. But we feel safe in saying that most of these efforts fall far short of the perfection of (*Please turn to page 70*)

6

For his commercial line Joseff creates such pieces as: Flower pins (Fig. 4) in black, ivory and well-chosen colors—some speckled with gold. Gold or silver colored metal centers are attached by special rivets screwed in by hand. Gruesome, savage-looking heads (Fig. 5), to pin on at the neckline or shoulder, flaunt huge metal nose rings and earrings. Replicas of antique jewelry (Fig. 6) have skillfully designed heads and other motifs in ornate metal frames. The plastic parts are all injection molded of Tenite by Merrigan Plastics

Corridor leading to the main exhibit hall at *L'Age des Plastiques*, recent plastics exhibit in Paris, is illuminated by convex plastic wall lights simulating bas-relief decorated Roman shields, and columns topped with urns, lighted from within, all made of Cristoplem. Huge rectangle in classical relief design, over the door, is the same material. Plastic ornaments and jewels fill the display cases

L'AGE DES PLASTIQUES

by GRACE ALEXANDRA YOUNG

France finds plastics worthy of a National Annual Exhibit

PARIS UNDERSTANDS FROU FROU. EACH SEASON the world snatches out of this "Woman's Town" shiploads of the little details that pretty-up women's dresses and hats and bags and gloves. But there are always plenty of new surprises when we go back again. It was the women's part of *L'Age des Plastiques* that stole the Paris plastics show in June.

The plastics exposition is an annual event in Paris. It is open to the public in the *Maison de la Chimie*, a huge modern building for various chemical projects. As a member of the jury which each year views so analytically the products which American manufacturers submit to the Modern Plastics Competition, I had one *pied* out the *porte* the minute the date of the exposition's opening was announced in the Paris dailies.

My mental memos the opening day went something like this: Hmmm. . . I'd be glad to own a lot of this plastic jewelry. . . . At last something new for lampshades!. . . These dolls' heads have such transparency, like the freshness of a baby's skin. . . And the faces are designed without that vacant startled look, so that their little selves seem to make facial sense. . . or good nonsense. . . What a wonderful and simple idea, to surface a screen with big plastic triangles!. . . Where are the literally thousands of papa radios and mamma radios and college radios and baby radios that are always present for roll call in the American plastics competition—Here there are only two or three sort of thrown off into a corner. . . . These huge clear plastic airplane cowls are so handsome I'd like to title them *Abstractions* and

take them back to our Museum of Modern Art for its permanent collection.

The rest of the exposition was routine, as far as I was concerned, I wanted to get back to the jewelry and ornaments. They had something. I was trying to figure out what.

That mysterious ingredient which makes French plastic jewelry right, is what makes women exclaim, "Oh, it looks very French!" when they are admiring a hat or a bracelet or a costume. It's all femininity's genuine tribute to French authority in design, patience in workmanship and everlasting romanticism.

"Authority in design" is the sort of big-sounding phrase which we writers are always putting down for a smoke screen to cover up what we don't know. But examine with me several of these pieces in the cases at *L'Age des Plastiques* and I think you will agree that French authority in jewelry design isn't just something that looks important in print.

Here is an ornamental chain made of inch-long links. The red plastic of which it is made is handled something like stone, and something like wire. It is a red never seen in commerce—off all familiar shades, with a stone-like suggestion which is heightened by tiny flecks of cream in the material.

And there is a clasp for a belt, molded and then cut with just a few incisions to give form and a suggestion of the depth of the material. A less knowing designer would have furred up the detail into unpleasant thin bits, so giving too much fussy detail in an inexpensive material. He would have had strong lines going in two directions, each killing the strength of the other. He would not have known that one carved stroke in the right place would make the too-heavy molded shoulder seem perfectly sculptured.

Look at this tri-colored boutonniére—it changes texture and rearranges the swirl of lines in the petals each time the color changes. And each flower has one of the other colors repeated in its center—with three precise leaves arranged to bring the eye back always to the center whorl. In our more hurried American way, we would probably have made all three of the flowers in the same stylized form, taking the plus of color and letting it go at that.

The French take time to think before colors are decided or motif established. They decide first the mood they want to create in the product. If, for example, they are making a boutonniére, they are making it for a woman who wants to wear flowers—she is signalling to the world that she is lighthearted, and that she is, in a way, one with nature. Flowers, (*Please turn to page 72*)

Room-high ribbon of thick, clear, green plastic, held up from a billowing plastic plain by a huge plaster hand (top photo), symbolizes the theme of the exhibit. Right—Widely diversified objects, made of acrylic plastics, are grouped around a three-dimensional chart demonstrating properties common to all

DINNER AT 8

Photos courtesy of

UNITED AIR LINES

COOKING and serving food above the clouds was incomprehensible only a few short years ago. Today, it is an accepted part of the fine service rendered by all great air lines.

Few appreciate the vast amount of research that forms the foundation of the many conveniences now offered by these great ships of the sky.

Always seeking maximum strength combined with minimum weight, new materials are being tested constantly to prove conclusively their adaptability to the rigid requirements of air service. Thus, a new kind of dinnerware, molded by The Bryant Electric Company became the choice of famed United Air Lines.

Plaskon is ideally suited to applications of this type. It is light in weight—has great strength. It is shatter proof—will not chip, rust, corrode or tarnish. The surface is smooth, hard—easy to clean. Being solid molded color, the finish is permanent—retains its lustre. Neither scratching nor abrasion injure its color value. Plaskon colors are uniform, clear, will not fade. They range from purest white through dainty pastels and brilliant hues to jet black.

Molded Plaskon is a sanitary material as well. It is odorless, tasteless, inert. Water, organic solvents and food oils do not affect it.

Plaskon's unusual qualities have made it the world's largest selling urea-formaldehyde plastic. Investigate its advantages. Write or wire and an experienced Plaskon representative will be sent to confer with you. No obligation!

PLASKON COMPANY

Incorporated

2121 SYLVAN AVE. TOLEDO, OHIO

Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

thousand feet!

Airline Dinnerware as produced from Plaskon by Hemco Plastic Division of The Bryant Electric Company, Bridgeport, Connecticut.

For their famed Mainliners, United Air Lines claim—"the finest service—the last word in travel comfort . . . the nation's largest, most powerful airliners. Spacious. Unusually quiet. Luxurious reclining lounge chairs. Cool, clean, comfortable. And the finest food aloft . . . prepared in United's exclusive airline kitchens," and served on Plaskon Dinnerware—light, sanitary, attractive, to lend zest to the appetite and charm to the occasion.

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

THIS PREMIUM BOOSTS SALES

"TESTED IN 1950 STORES IN SIX STATES, THE PREmium produced a 95 percent increase in sales. It costs the dealer no more, nor does he lose any other sale because of it. Free with every tube of Forhan's purchased it sells on sight." The makers of this toothpaste call their new sales-promoting gum massager a "natural." However, a long trail of careful planning, smart designing and trial-and-error experimentation lies behind the presentation of this highly successful premium, and plastics enter at the outset as first choice!

But what "makes" a premium?

About a year ago, a New York practising dentist came to the company with an interdental stimulator for vitalizing gums. Its advertising potentialities it seemed to the company were tremendous—a premium that goes with the product, is not extraneous to it. Welcome to the retailer, it would not take away the sale of any other item in the store. Neighborhood dentists approve of the safe, hygienic home treatment. Patents were secured on the massager and with promotion plans in progress on the one hand, the company turned the invention over to their engineers for further development.

To take full advantage of color opportunities, lightweight, flexibility, and economy of material and molding operations, cellulose acetate was decided upon, since no additional heat had to be applied to this item for holes or notches (as in a toothbrush). Smooth finish, firmness, yet sufficient pliability for manipulation, the plastic immediately settled the material question, leaving only problems of design to be determined.

Injection molded, the handle of the massager was grooved for a two-fold purpose—to break up the long flat surface and to form an easy-to-grip finger rest. A decorative pin-bead or collar, serving to hold the rubber head in position, was slipped on to the molded part and attached by acetone.

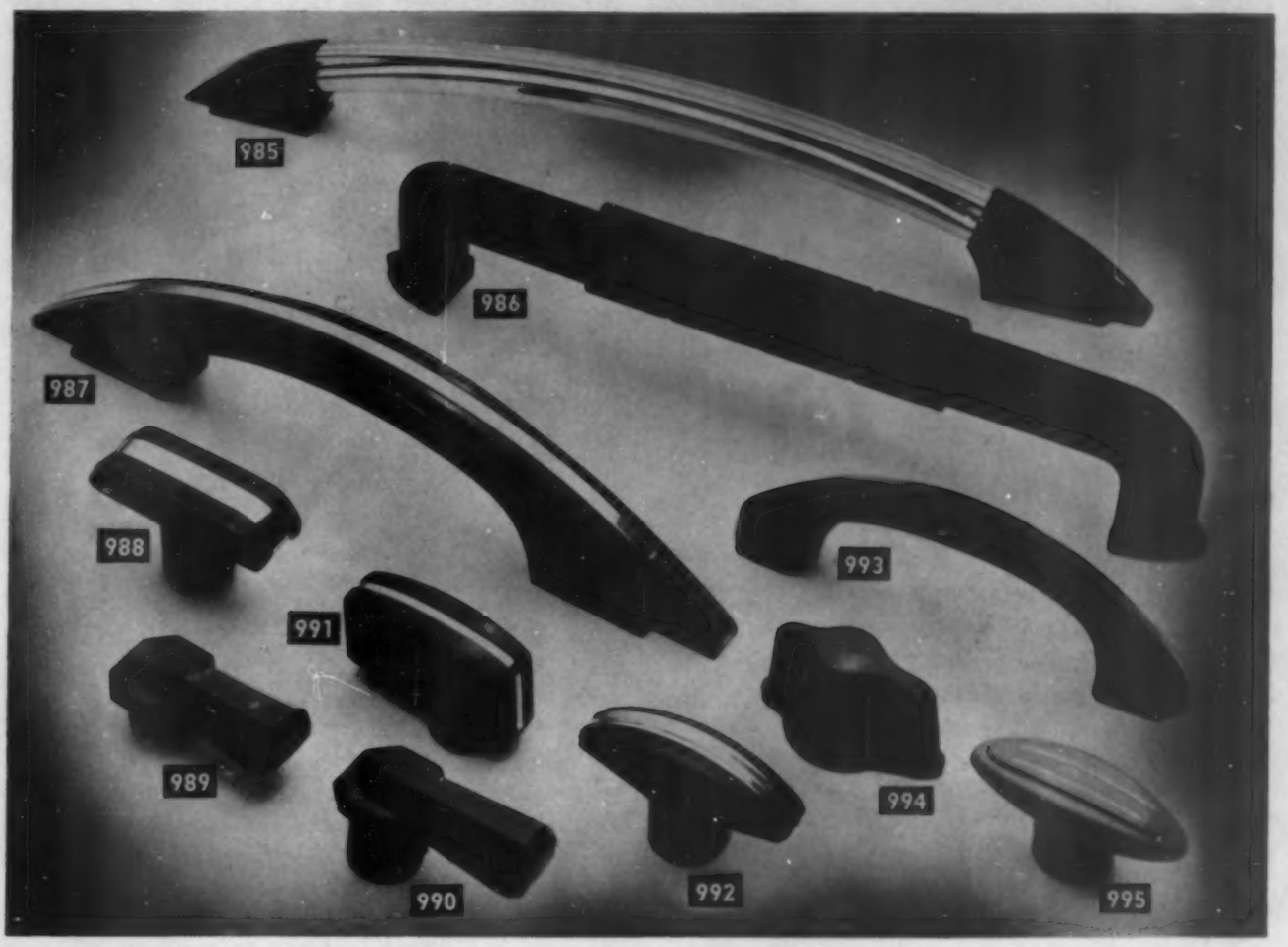
Made of bleached pure gum rubber, the soft head with its three cylindrical projections does the actual work of stimulating the gums. Getting this part to fit firmly on a material that could not (*Please turn to page 64*)

Forhan's new gum massager's handle is injection molded of Tenite in six color combinations by Bridgeport Moulded Products, Incorporated

Stock Molds

SHEET EIGHTY-FIVE

Suitable for many diversified uses, attractive modern handles and gas cocks, in colors, mottled patterns, or with metal trim, are available without mold cost from stock molds. Address Stock Mold Department, Modern Plastics, Chanin Building, New York, N. Y. giving item and sheet numbers



Sheets One to Fifty-Two, reprinted in book form, twenty-five cents in coin or stamps

985. Curved handle with ribbed chrome center piece and molded ends, each 1 7/8 in. by 3/4 in. with center screw. Overall length, 12 1/4 in., 8 1/2 in. between ends, 1 5/8 in. high at center

986. Rectangular hollow handle, with metal threaded curved ends. Decorative center has vertical red grooves. Overall length, 9 3/4 in., 7 7/8 in. between ends, 1 7/8 in. high at the center

987. Curved hollow handle, with metal stripe 3/8 in. wide. Threaded screws at ends. Overall length, 9 in., 4 3/4 in. between ends, 1 3/4 in. high at center

988. Gas cock handle with threaded metal screw and decorative metal stripe, 1/4 in. wide. Overall length, 2 3/16 in., 3/4 in. wide, 1 1/4 in. high

989. Mottled gas cock handle with 3/8 in. opening. Overall length, 2 1/16 in., 7/8 in. high

990. Gas cock handle, same as 989, but in solid color

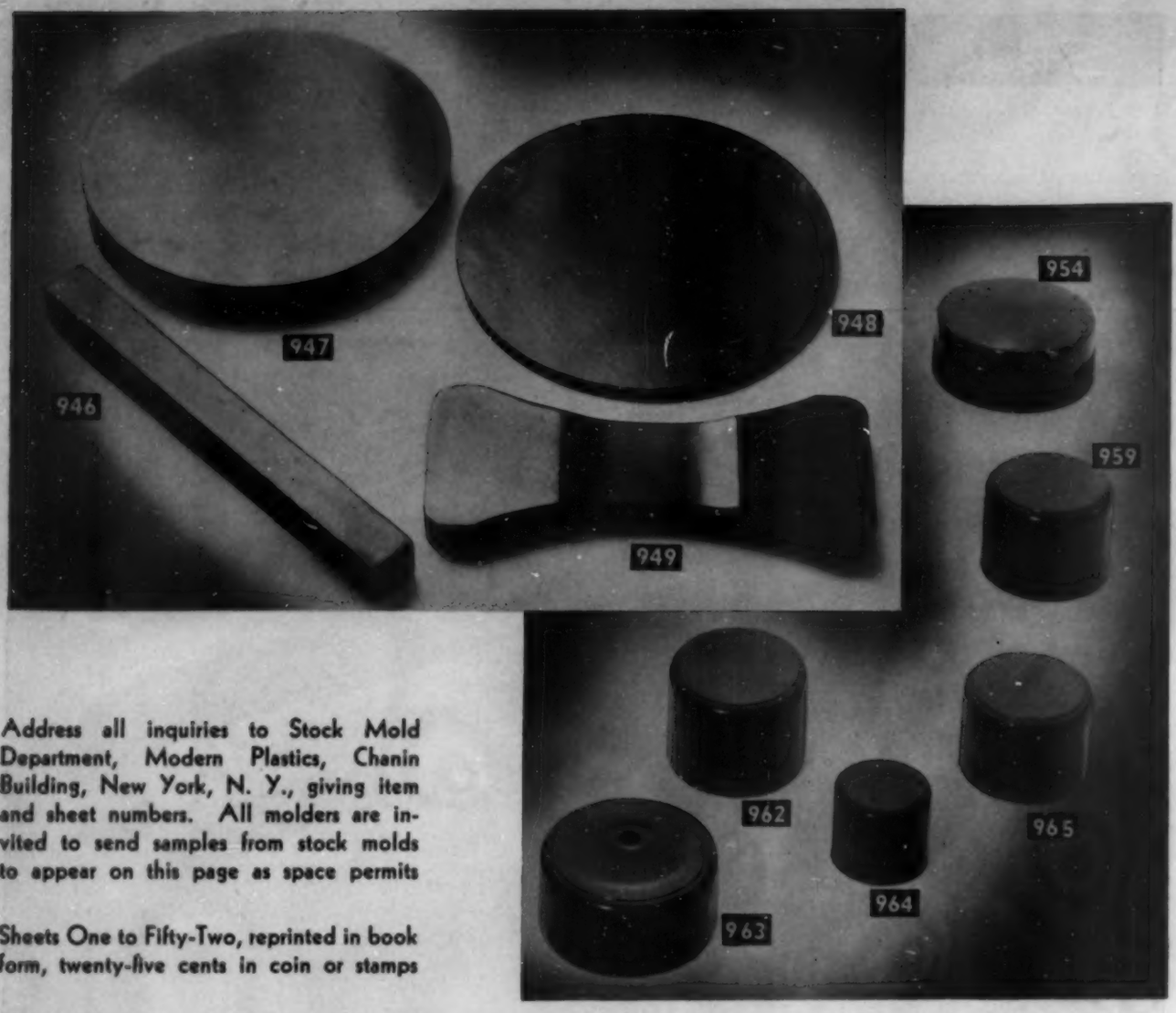
991. Gas cock handle with two 3/8 in. openings. Overall length, 2 in., 1/2 in. wide, 1 1/8 in. high. Decorative metal stripe, 1/8 in. wide

992. Curved gas cock handle with 3/8 in. opening. 2 1/8 in. overall length, 1 1/4 in. high. Decorative ridged metal stripe, 5/8 in. wide

993. Curved ridged handle with threaded metal screws at ends. Overall length, 5 in., 3 in. between ends

994. Directional type gas cock handle, with openings at side and bottom. Overall length, 1 15/16 in., 1 in. high at center

995. Red, curved gas cock handle with contrasting colored stripes. Overall length, 2 1/8 in., 1 in. high. Metal threaded screw, 3/16 in. in diameter



Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, New York, N. Y., giving item and sheet numbers. All molders are invited to send samples from stock molds to appear on this page as space permits

Sheets One to Fifty-Two, reprinted in book form, twenty-five cents in coin or stamps

Stock Molds

SHEET EIGHTY-SIX

Stock molded rods and disks, used as standard test specimens, and decorative bottle caps in several sizes may be obtained without mold cost from stock molds. Names and addresses of molders will be supplied on request

946. Test rod, 5 1/2 in. long and 1/2 in. wide by 1/2 in. in height; weighs 1 1/2 ounces

947. Circular test piece, 4 in. in diameter and 1/2 in. high; weighs 7 ounces

948. Circular test piece, 4 in. in diameter and 1/8 in. in height; its weight is 1 1/2 ounces

949. Test piece, 4 3/16 in. long; 1 1/2 in. wide and 3/8 in. high at broad ends; 1 in. wide and 1/4 in. high at center; weighs 1 1/2 ounces

954. Decorative shallow finish 28 mm. threaded cap with finely ribbed edge; 1 1/4 in. overall diameter; 1/2 in. high

959. Decorative medium finish 24 mm. threaded cap; 7/8 in. overall diameter, 5/8 in. high

962. Decorative tall finish 22 mm. threaded cap in red; 7/8 in. overall diameter; 11/16 in. high

963. Decorative shallow finish 28 mm. threaded cap with sprinkler perforation; 1 in. overall diameter; 1/2 in. high

964. Decorative tall finish 18 mm. threaded cap; 9/16 in. overall diameter; 1/2 in. high

965. Decorative medium finish 22 mm. threaded cap in red; 7/8 in. overall diameter, 9/16 in. high

STRUCTURAL CONSIDERATIONS FAVORING PLASTICS IN AIRCRAFT STRUCTURES

by C. F. MARSCHNER*

SUMMARY: The use of plastic materials in aircraft structures should be predicated on the principle of simplifying structures and producing lighter, equally strong assemblies, rather than on decreasing unit costs merely by the application of mass production methods. Quantity production will be a natural outgrowth of structural simplification. This process cannot satisfactorily be reversed in industries where the demand is limited. The ideal aircraft structural material will be characterized by: high elastic and shear moduli with a high elastic limit, ability to be formed and worked in large pieces on relatively inexpensive equipment, ease of attachment of separate parts to each other, reasonable shear, tensile and compressive strengths, low moisture absorption and good durability. Plastics offer the possibility of satisfying all these requirements.

IN THE CONSTRUCTION OF AN AIRPLANE, LOW production costs may be achieved (1) by a combination of quantity production, cheap processing methods, and low raw material costs, or (2) by simplification and standardization of parts in the basic airplane structure. Obviously, there is a definite limit to the quantity of airplanes which can be marketed, as well as a limit to cost reductions brought about by technological improvements in production methods. On the other hand, structural simplicity can only be gained at the expense of a weight penalty when present materials and types of construction are used. Standardization of parts is also limited, especially by the absolute necessity of saving structural weight. Were it not for weight penalties, simplification of the airplane structure would be the most satisfactory method of reducing production costs, since, at the same time, maintenance would be facilitated due to a decrease in the number of parts to be inspected and replaced. Reduction in joints and attachments would make for greater structural integrity and dependability.

Certain fundamental relationships are known to exist between several physical properties of materials and their behavior under different types of loads and in various types of structures. A study of materials and their suitability to different applications in the aircraft structure is presented here because it is believed that it may be of considerable interest to those promoting the development and use of plastic materials in the manufacture of aircraft components. It will be apparent that structural simplicity may be achieved without the usual weight penalties, providing more suitable materials are developed. It is hoped that this article will serve to indicate the lines that such development should follow.

* Research Engineer, The Glenn L. Martin Co.

Structural design

While the ultimate and yield strengths of materials are of considerable importance in the design of aircraft structures, they are far from being the sole criteria which must be considered. This is particularly true in the case of modern stressed skin and monocoque structures where such factors as minimum gages, plate rigidity, maximum permissible deflection, local instability, column stability, and fatigue limits often determine the size, shape, and weight of parts, rather than the values of yield or ultimate strength of the material from which these parts are to be fabricated. Airplane structures are no longer constructed or stress-analyzed similarly to the structures of automobiles, buildings or bridges. The loading conditions and form requirements of the airplane have made it necessary to use the stressed-skin and monocoque types of construction in order to attain the lowest possible weight with the materials now available.

When stressed-skin construction is used, rib and stiffener spacings must be such as to develop high stresses in the material. Due to the relatively high density of metals, thin sections are employed, making it necessary to use close spacings. This increases the number of ribs and stiffeners which must be used to support the locally unstable sections and adds to the complexity of the structure by increasing the number of parts and the cost of assembling them. If thick walled sections could be used, monocoque construction would be possible. This type of design is the ideal in stressed-skin construction.

A comparison of the relative merits of materials strictly on the basis of the commonly used strength-weight and modulus-weight ratios is often inaccurate and unsatisfactory. Only when the loading conditions, loading requirements, and shape requirements are known can the proper choice of a material be made. The charts and tables presented in this paper were developed in order to assist in comparing new materials with existing ones, once the critical design condition and several

of the basic physical properties of the new material are known. It will become apparent that some types of materials are more efficient in certain types of structures and under certain loading conditions than are other materials, even though they may be inferior in regard to ultimate tensile, compressive or yield strengths. Naturally it is impossible to devise a set of charts to give an absolutely accurate or infallible comparison between materials used for structural purposes, because changes in detail design may often overcome some deficiencies existing in the materials. However, they will prove satisfactory in making comparisons between the several possible materials which can be used in any particular type of design. They also will serve to indicate the logical methods and materials to use in the design of structural parts in order to effect the greatest possible saving in weight.

Following is a list of eight conditions which govern structural design.

1. Axial deflection (stable members, such as struts, etc.). See Curve A, Fig. 1.
2. Bending deflection (beams, stiffeners, etc.). See Curve A, Fig. 1.
3. Torsional deflection (thin walled members, such as monocoque fuselages, box beams, etc.). See Curve D, Fig. 2.
4. Local instability (ribs, stiffeners, skin, etc.). See Curve B, Fig. 1.
5. Plate rigidity (skin, hull bottoms, flooring, etc.). See Curve C, Fig. 1.
6. Torsional deflection (torque tubes for controls, etc.), where.

$$\theta = \frac{TL}{GI_p},$$

the letters having the same significance as in Table I. See Curve E, Fig. 2.

7. Minimum gage (akin to plate rigidity and dependent on minimum gages obtainable or minimum for the undeterminable handling loads).
8. Ultimate strength. See Curves in Fig. 3.

The first six conditions may be represented by formulas given in Table I. Most of these are reducible to curves (Figs. 1, 2, and 3). The curves are arbitrarily based on aluminum alloys, which are now the materials most frequently used in the construction of airplanes.

Development of curves

There are two physical properties of metals which are virtually unaltered by heat treatment or cold working. These are (1) the specific gravity, and (2) the moduli of elasticity (E) and rigidity (G). Synthetic materials do not follow this rule and hence we may hope to alter these properties in such a way that they may be made more satisfactory and useful for structural purposes. For all other materials the yield points, elongation and ultimates may vary throughout a wide range without affecting these two properties. Referring to Table I, it will be observed that the terms E or G occur in equations 1, 2, 4, and 5. If, then, the other terms in these expressions may be reduced to constants and a relationship established between all or some of them and the specific gravity, it will be possible to plot curves, based on any one material, of moduli versus specific gravity for the various loading conditions. This is done in Figs. 1 and 2. These curves show the minimum moduli that are required to give equal *load* carrying ability or equal deflections for the same *weight* of structure, similarly stiffened and critical in the same loading conditions, as the equivalent aluminum alloy structure.

TABLE I

STRUCTURAL DESIGN FORMULAS

Formula	Used to Compute
(1) $\Delta = \frac{PL}{AE}$	—Axial deflection in stable members such as drag struts, truss members, cabanes, etc.
(2) $\Delta = K\frac{M}{EI}$	—Bending deflection of stiffeners, beams, etc.
(3) $I = \frac{at^3}{12}$	—Moment of inertia for use in (2) to determine "plate rigidity" or resistance to "tin canning" in wing skin, hull plating, etc.
(4)* $f_{bu} = \frac{\pi^2 Et^2}{3(1-\mu^2)a^2}$	—Buckling load where instability can occur as in ribs, stiffeners, corrugations, etc.
(5)** $\theta = \frac{TCL}{4A^2Gt}$	—Torsional deflection in closed sections having thin covering in comparison with other dimensions.

Where: Δ = Deflection; P = Load; L = Length; A = Area; E = Modulus of elasticity; I = Moment of inertia; θ = Angle of rotation in radians; K = A constant, dependent on load and size; M = Moment; t = Sheet thickness; a = Sheet width; μ = Poisson's ratio; C = Periphery of section; G = Modulus of rigidity; T = Torque

Using formula 1, Table I, it is apparent that the terms P and L will become constants due to general design requirements of load and size. Then Δ is proportional to 1/AE, and for any value of Δ the product AE must be a constant. Now, to obtain the same weight, A is proportional to 1/specific gravity, and hence

$$\Delta \propto \frac{\text{Specific Gravity}}{E}$$

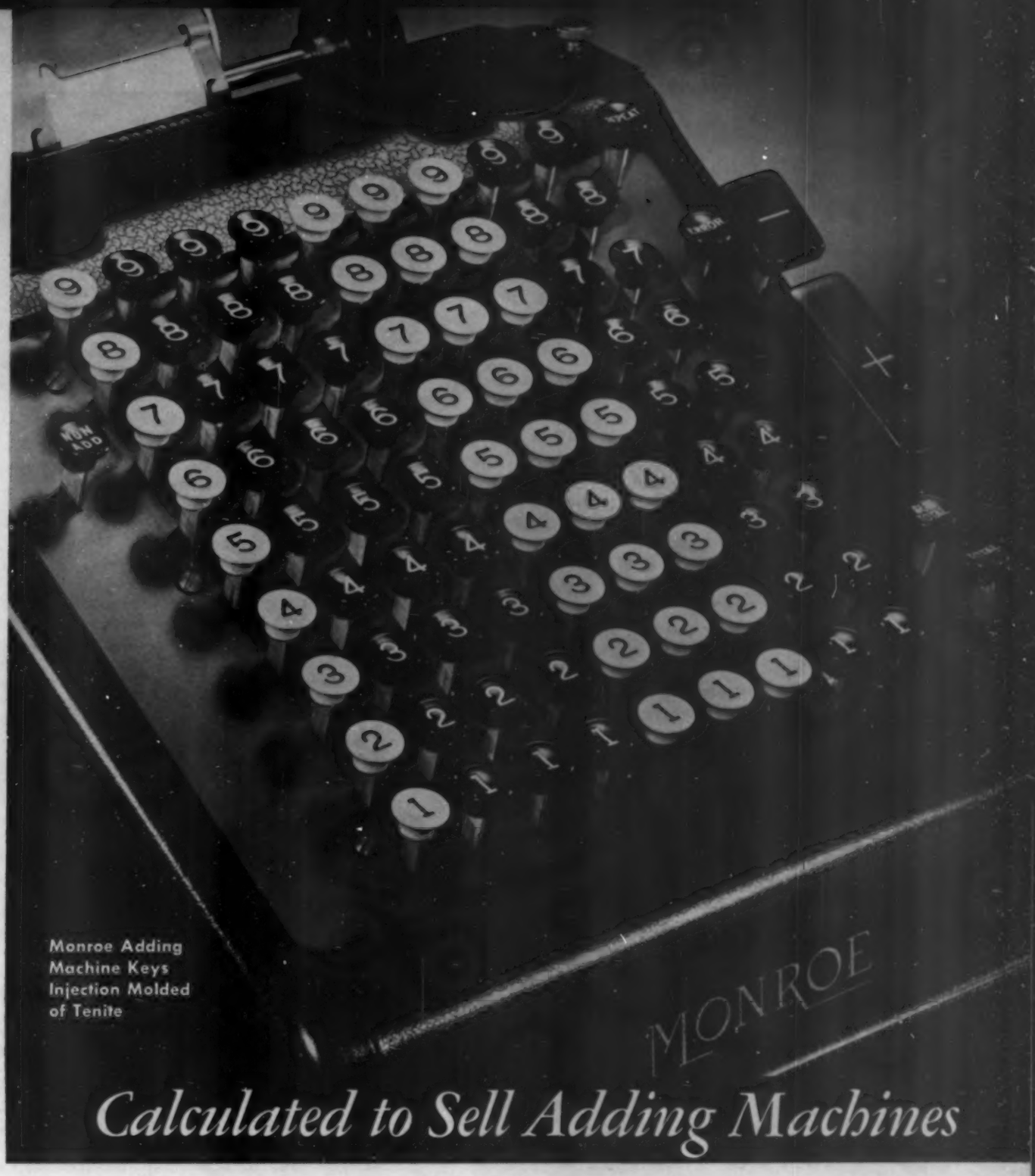
Thus, a curve of equal axial deflection based on aluminum alloys will be a straight line passing through the origin and the point of intersection of the specific gravity and modulus of elasticity for that material. This is represented by Curve A, Fig. 1, where E is plotted against specific gravity.

Formula 2, Table I, is used in determining bending deflection, as in beams. Again, general design requirements of load and size (that is, load distribution and beam length) will determine that KM is a constant and hence, Δ will be proportional to 1/EI. Now in a beam, $I = I_0 + Ad^2$, where I_0 is the moment of inertia of the flange around its neutral axis, A is the flange area, and d is the distance between the flange and beam neutral axes. I_0 is very small and may be neglected, (except in the case of materials having a *very* low specific gravity, such as wood). This assumption is favorable to the heavy materials. The term d may be assumed to be constant due to the usual ingenuity in design, and the fact that similarly placed beams will have the same depth, no matter what material is used. Hence I is proportional to A and Δ is again proportional to 1/EA, as above. Thus, Curve A, Fig. 1 may also represent bending deflection in beams and stiffeners.

In formula 3, Table I, it will be observed that in the case of two flat sheets or plates of different thickness and equal width, I is proportional to t^3. Hence, to determine *plate rigidity* (deflection of plates under

* Niles and Newell, Vol. I, second edition, page 290.

** Ibid, page 189.



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loads normal to their surface), t^3 may be substituted for I in the equation $\Delta = KM/EI$, so that $\Delta \propto 1/Et^3$ when KM is constant. Now, since $t \propto$ 1/specific gravity, for plates or sheets of equal weight, we find that

$$\Delta \propto \frac{(\text{Specific gravity})^3}{E}$$

This is plotted as Curve C in Fig. 1 to show the effect of modulus of elasticity and specific weight on plate rigidity. Again, aluminum alloys are used as the base.

Formula 4, Table I, represents the buckling load where local instability can occur. Where the same stringer spacings are used, despite a change in material, and where the quantity $(1 - \mu^2)$ will remain relatively constant (which it will for all usable materials) it is apparent that f_{bu} is proportional to Et^2. Again $t \propto$ 1/specific gravity, and hence

$$f_{bu} \propto \frac{E}{(\text{Specific Gravity})^2}$$

and Curve B, Fig. 1, shows the relationship between E and specific gravity for conditions where instability exists. This curve is also based on aluminum alloys for materials having different E versus specific gravity combinations, but a weight equivalent to the aluminum alloys.

Formula 5 gives the torsional deflection in closed sections where the gage of the skin is relatively small with respect to the other dimensions. Here the quantity TCL/4 is constant for any particular design, and therefore, θ is proportional to $1/A^2Gt$. Also, A is proportional to t, and t in turn is proportional to 1/specific gravity as above, and hence

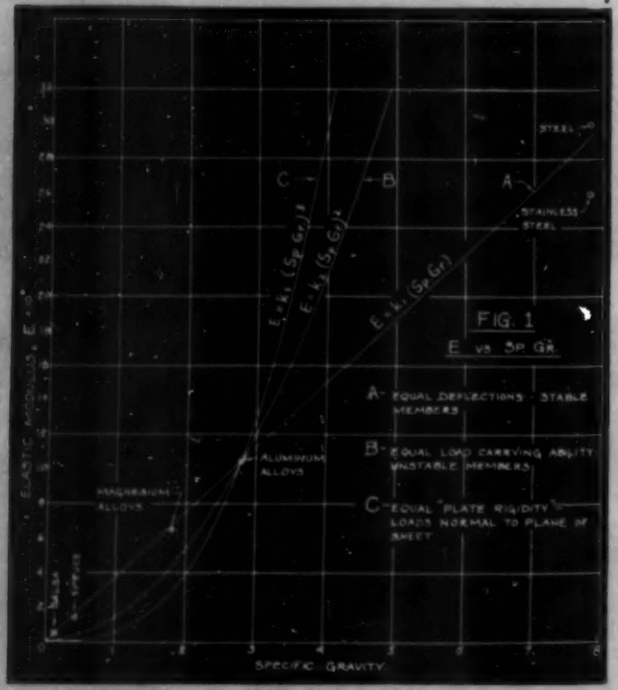
$$\theta \propto \frac{(\text{Specific Gravity})^3}{G}$$

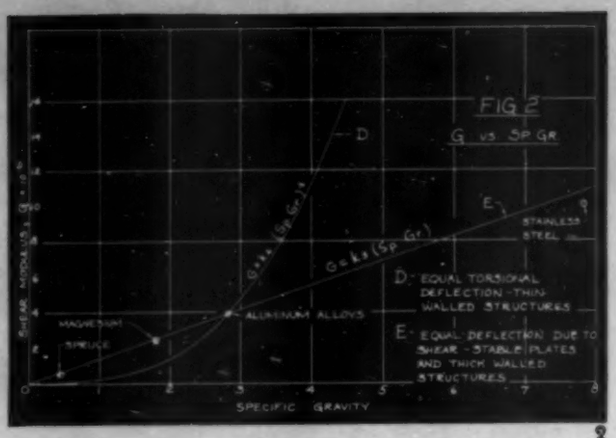
Curve D, Fig. 2, shows the relationship between G and specific gravity for equal weight and equal angular deflection based on dural.

Curve E, Fig. 2, shows shear deflections in stable plates, and thick walled tubes. Obviously this will be a linear function.

In Fig. 3, ultimate strength is plotted against specific gravity. It is interesting to note that the values for average allowable strength of the steel, aluminum and magnesium alloys, as well as the values for spruce and even balsa, fall nearly on a straight line when the ultimate strength is plotted against specific gravity. A similar straight line relationship seems to exist for these materials between elastic modulus and specific gravity, as may be noted in the case of Curve A, Fig. 1. Due to the inability of altering values of E, as noted previously, the latter coincidence might point to a fundamental physical relationship between certain classes of materials.

1





2

Discussion of curves

In Figs. 1 and 2, a point falling on any particular curve will represent a modulus—specific gravity combination which will give a structure having *the same weight and load-carrying ability as a similarly proportioned aluminum alloy structure under load conditions represented by that curve.*

Curve A, Fig. 1, shows that a straight line relationship exists between the modulus of elasticity and specific gravity for equal deflections of shafts, struts, etc., under axial load, and for beams and stiffeners, of equal depth and suitable area, under bending loads. Equal weights are indicated for equal deflections. Here low weight materials have no advantage over heavier materials, except that the smaller cross sectional area of high density materials of equal weight and length may cause them to fail as long, rather than short columns where there are axial loads, or where the decreased I of beams of heavy materials may permit torsional deflection in bending due to slight eccentricity in loading condition. The latter possibility may be dismissed in most cases where beams are prevented from twisting by ribs, etc. The design condition represented by Curve A indicates that a constant value of E/specific gravity is required. Due to the present high state of development of methods of stress analyzing the locally stiffened stressed skin structures, more parts are actually designed by the condition represented in Curve B, which does *not* require that a constant value E/specific gravity be maintained.

Curve B, Fig. 1, indicates that considerably greater stability, i. e., resistance to local buckling in stressed skin sheets and stiffening sections, may be expected from the low gravity materials than from dense materials, if total structural weights are to be equal. Such resistance to buckling is quite important where it is desired to develop the higher compressive stresses necessary to structurally economical designs. Reading the curve directly, it may be seen that for similarly stiffened sheets or for similarly dimensioned stiffening sections (hat, zee, angle, etc.) parts made from high density materials will weigh more than similarly designed aluminum alloy parts. Lighter materials will permit a weight saving to be realized. For a direct comparison between several materials designed by the condition of local instability, see Column 3 of Table II. The addition of more stiffeners or more complicated stiffening sections would permit the weight difficulties of high density materials to be overcome, but would also increase fabrication costs because of the additional number of detail parts required and the cost of attaching them to the rest of the structure.

Here it is well to observe that in some cases instability might not exist in an aluminum alloy or magnesium stiffener, whereas, it could exist in a steel stiffener having equal weight and similar dimensions (except for the sheet thickness). For example, in corrugated sheets where the length, depth of corrugation, and distance between nodes is the same, but where the gage may be changed to reduce weight, there is a certain gage below which local instability will exist in the *flats* between the nodes. A change in gage, of course, results in a change in form factor, all other dimensions remaining unchanged. If the form factor were to be kept constant, the depth and distance between nodes would decrease with a decrease in gage and the corrugation would become unstable as a column. In either case, weight will be lost; in the first case because of the decreased efficiency due to local instability; in the second case, because of the necessary addition of ribs or frames to prevent column instability. (*Please turn to page 68*)

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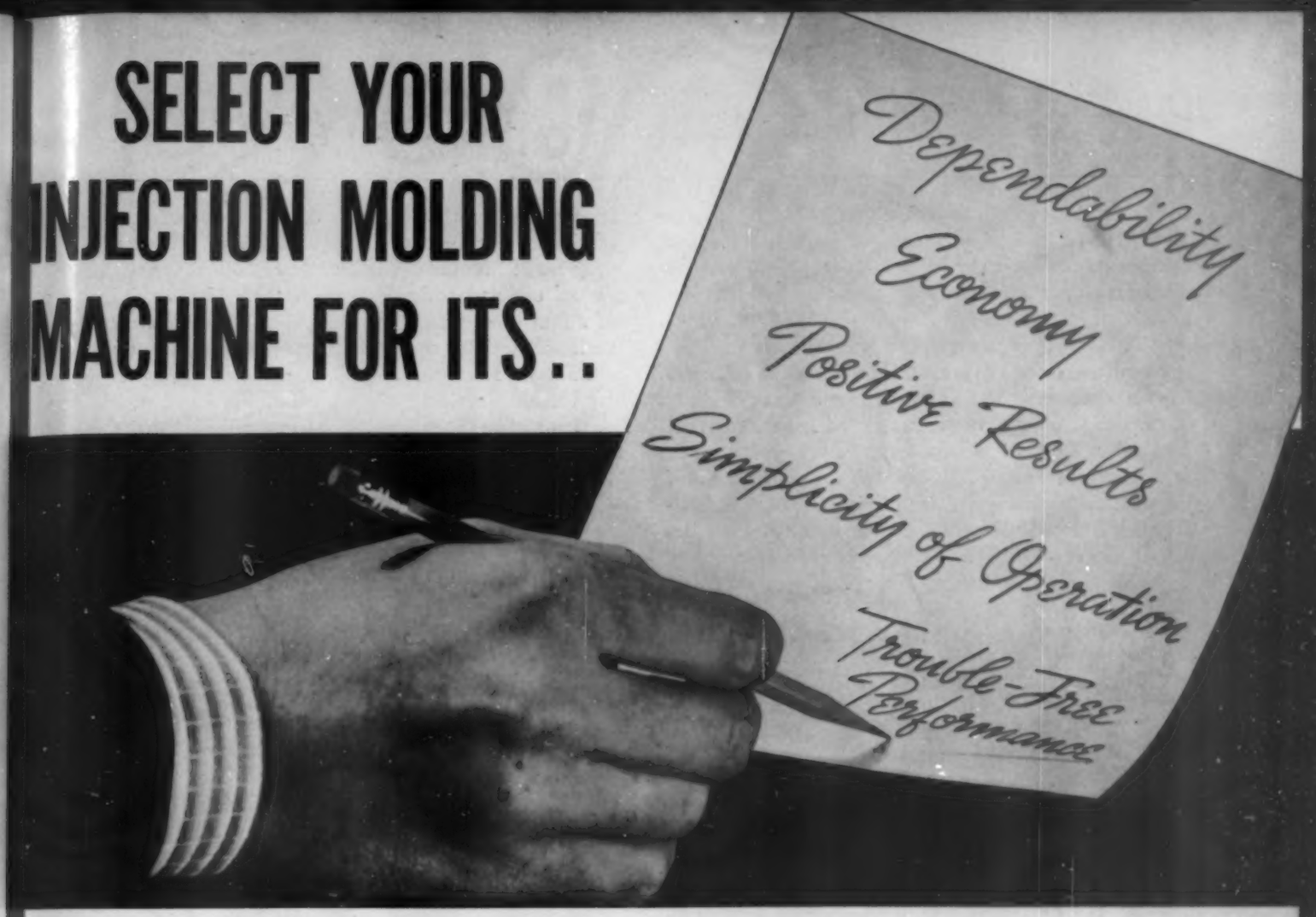

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PLASTICS AT BOSTON A. C. S. MEETING

SEVEN PAPERS ON VARIOUS THEORETICAL ASpects of resin chemistry have been scheduled for the meeting on September 14 of the Plastics Group of the American Chemical Society at its semi-annual convention in Boston. Abstracts of these are presented below.

Other features of interest to plastics chemists at this convention are the "Symposium on Resins and Plastics from Hydrocarbons" on Monday, September 11, and the "Symposium on X-Ray Studies of Substances of High Molecular Weight" on Tuesday, September 12. The former symposium is sponsored by the Division of Petroleum Chemistry with the participation of the Division of Paint and Varnish Chemistry of which the Plastics Group is a part, and the latter symposium has been organized by the Division of Physical and Inorganic Chemistry. A report of the papers presented at these sessions will be published in a later issue of this journal.

SOME RELATIONSHIPS BETWEEN POLYVINYL ACETATES AND POLYVINYL ALCOHOLS. W. H. McDowell and W. O. Kenyon. A number of polyvinyl acetates of various degrees of polymerization were deacetylated and the resulting polyvinyl alcohols were reacetylated to polyvinyl acetates. The average degree of polymerization and specific viscosities of the acetates obtained by reacetylation were very much lower than those of the corresponding original polyvinyl acetates. It is suggested that this decrease of the average chain lengths may be due to rupture of unstable linkages present in the linear molecule.

BEHAVIOR OF POLYVINYL CHLORIDE PLASTICS UNDER STRESS. J. J. Russell. Stress-strain diagrams for several polyvinyl chloride plastics over a temperature range of −50 to 80 deg. C. were described. It was shown that for such compounds containing little or no filler, Poisson's ratio is about 0.5. The stress-strain curves were observed to change in shape as the temperature was lowered and ultimately to reduce to a "brittle point." The latter corresponds to the "high elasticity temperature" of Houwink. This temperature is characteristic for each composition of plasticized polyvinyl chloride. The stress versus temperature plot was shown to consist of at least two portions, a lower temperature portion exhibiting a linear relationship between stress and temperature and a higher temperature portion having an exponential relationship. Heats of activation were calculated for the higher temperature portion and were found to be of the same order of magnitude as those obtained for a number of pure metals.

KINETICS OF POLYESTERIFICATION AND THE RANDOMNESS OF POLYMERIZATIONS. P. J. Flory. Studies of the kinetics of linear polyester formation have made possible a much clearer understanding of the influence of molecular weight and viscosity on reactivity. It was observed that the rates of polyesterification and of simple monofunctional esterification vary with the progress of the reaction in exactly the same way when carried out under identical conditions. The reactivity of a functional group, therefore, does not depend upon molecular weight, and the linking of the molecules with one another must proceed purely at random. The viscosity increases rapidly during the polyesterification, but does not affect the rate of the reaction provided that the mixture is continually stirred. After the viscosity has become moderately high, the reaction becomes extremely slow if some means of agitation is not used. These observations are in line with modern concepts of reaction mechanism. The random nature of linear condensation polymerization makes possible the application of simple statistical methods to the calculation of the numbers of molecules of various sizes. By analogy, one must expect polyesterifications of higher functionality (e. g., three dimensional polymers) to proceed at random. However, a statistical treatment for such polymers is complicated by the occurrence of intra-molecular reaction to an appreciable but uncertain extent. In kinetic interpretations of vinyl polymerizations it has been customary to assume that the viscosity and molecular weight do not influence reactivity. The results reported lend support to the reasonableness of these assumptions.

THE POLYHYDRIC ALCOHOL-POLYBASIC ACID REACTION. V. THE GLYCERYL SUCCINATE AND GLYCERYL MALEATE POLYESTERS. R. H. Kienle and F. E. Petke. In the glycerol-succinic acid reaction, slightly less water was evolved than is required by interesterification, which is evidently all that is involved, whereas in the glycerol-maleic acid reaction, considerably more water was evolved than calculated for simple interesterification, suggesting that anhydride intraesterification and addition polymerization are also occurring. Acid values, saponification values, ultimate analyses and molecular weights were determined on samples taken in the course of these reactions. Monomolecular spreading curves on 0.1 *N* HCl and infra-red absorption spectra were measured for both polymers. The spectrum of glyceryl maleate shows a masking of the aliphatic C=C bond, supporting the postulation of some addition polymerization for this polyester. In the glyceryl succinate reaction, 50 percent esterification was attained almost immediately using the anhydride, whereas with the acid considerable time was required to reach the same degree of reaction. After this stage the reactions proceeded quite similarly to gelation at equivalent degrees of reaction. Data for glyceryl succinate and glyceryl maleate indicate that gelation occurs without formation of large macromolecules, but rather when a certain concentration of low molecular weight, three-dimensional molecules is formed.

(*Please turn to page 58*)

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Plastics Digest

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General

CHEMURGY MARCHES ON. R. D. McMillan. Conn. Ind. *17*, No. 5, 9–10 (May 1939) At the Fifth Annual National Farm Chemurgic Conference, V. H. Schoffelmayer spoke of the South's first newsprint mill in Texas and said that from paper the chemist will lead the industrialist into the rayon and plastics industries and that the next 12 years will bring capital to the South to aid in the expansion of these industries. H. Levey described a low-cost, transparent, waterproof, packaging sheet made from a base film composed of hydrated starch and coated with waterproofing cellulose derivatives. W. H. Mason told about a new process for converting southern pulp wood into plastics. Visiting parties were shown the pilot plant at Laurel, Mississippi, where the Masonite Co.'s new wood plastic, *Benalite*, is being made experimentally at the present time.

BRITISH STANDARD SPECIFICATIONS. M. D. Curwen. Plastics *3*, 227–30 (July 1939). Specifications for resins of the phenol, urea, methyl methacrylate, styrene and vinyl types and for cellulose acetate are set forth. This is a paper presented at a Plastics and Synthetic Resins Conference held in Paris to promote international standard specifications. An editorial in this same issue of *Plastics* notes that the plastics industry is at present too fluid to confine its products by additional hard and fast specifications, but that standardization of tests, apparatus, and nomenclature throughout the industry is highly desirable.

ABRASIVE WHEELS. Plastics *3*, 224 (July 1939). A discussion of materials used in the construction of abrasive wheels. Aluminum oxide (alundum) is used for metal polishing, whereas silicon carbide (carborundum) is the abrasive employed for granite and glass polishing. The binders employed and the approximate percentage of wheels made with each are indicated as follows: clay-feldspar, 45%; sodium silicate, 20%; phenol-formaldehyde, 20%; shellac, 10%; rubber, 5%.

IMPERVIOUS CARBON EQUIPMENT. L. C. Werking. Chem. and Met. Eng. *46*, 362–4 (June 1939). A synthetic resin made *in situ* in the pores normally present in carbon and graphite reduces porosity to practically zero. The product, known as *Karbate*, is about twice as strong as the original base material, has a high heat conductivity, and is exceptionally resistant to chemicals. Its chief applications to date are as pipes for handling corrosive liquids and for heat exchange systems.

Materials and Manufacture

RESINS FROM CARBOHYDRATES. Brit. Plastics *11*, 84, 104 (July 1939). A review of patent literature on the preparation of resins from sugars and starch by reaction with cyclic ketones, phenol, urea and formaldehyde, respectively.

RUBBONE—NEW OXIDIZED RUBBER. Plastics *3*, 225 (July 1939). The properties of rubber after reaction with oxygen instead of sulfur are listed. In early stages, the product is quite fluid at 100 deg. C. and is useful as an impregnating agent.

SOME USES OF SULFONAMIDE RESINS. E. Albrecht. Rev. Gen. Mat. Plastiques *15*, 135–8 (May 1939). The preparation of these resins and their applications in safety glass manufacture, coatings, molding compounds, and for use as textile impregnating agents are reviewed.

PROCESSING OF VISCOUS MATERIALS. H. A. Levey. Chem. and Met. Eng. *46*, 371–2 (June 1939). Technique involved in mixing, transferring and filtering plastics are surveyed.

PETROLEUM, A SOURCE OF PLASTICS AND SYNTHETIC RUBBERS. H. Barron. Chem. Age. *41*, 3–6 (July 1, 1939). A comparison of coal and petroleum as raw materials for plastics manufacture. Polymerized isobutylene plastics (*Vistanex*) produced from cracked petroleum distillate are discussed.

Molding and Fabricating

ANCILLARY PROCESSES IN THE MOLDING SHOP. J. Butler. Trans. Inst. Plastics Ind. *8*, 48–68 (Jan. 1939). A discussion of operations in the molding shop other than molding itself, including pelleting, pre-heating, loading, shrinkage fixtures, drilling, trimming, tapping, hinge attachment, assembly, milling, polishing and engraving.

DESIGN OF KNOBS. H. Turnwald. Kunst.-Tech. u. Kunst.-Anwend. *9*, 225–30 (July 1939). Various constructions for knobs are illustrated and their respective advantages and disadvantages are listed.

ELECTROFORMING WITH IRON: THE EKKO PROCESS. A. W. Bull, J. W. Bishop, M. H. Orbaugh, and E. H. Wallace. Ind. and Eng. Chem. News Ed. *17*, 461–4 (July 20, 1939). The process offers quick and perfect reproduction of an object or pattern, usually with a very considerable saving in cost. Electrolytic iron has a heat conductivity nearly twice that of cast iron or steel, and can be hardened by carburizing, cyaniding, or other standard processes. Iron mold reproductions of photographs can be made by a special process which transforms the shadows in the original picture into depressions in a three-dimensional plaster-cast relief, from which an iron mold can be prepared by the electrolytic method.

STEEL FOR MOLD CONSTRUCTION. H. Briefs. Kunststoffe *29*, 185–90 (July 1939). The properties of steels of various compositions are cited.

Applications

PLASTICS IN PRINTING. Rev. Gen. Mat. Plastiques *15*, 170s–75s (June 1939). Machinery and molds for the preparation of printing type are described. Styrene resin is generally employed for this purpose because of its light weight and resistance to the chemicals present in printing inks.

LAMINATED PLASTICS IN BRITAIN'S LATEST LINER. Brit. Plastics *11*, 92–4 (July 1939). Resin-impregnated veneers have been extensively used for surfacing table-tops, dressing tables, and sideboards, and for partitioning on the *S. S. Mauretania*

RESIN-IMPREGNATED WOOD FOR PREFABRICATED HOUSES. Plastics *3*, 217–19 (July 1939). Resin-bonded plywood constitutes the exterior walls of a five-room bungalow built in Portland, Oregon, at a cost of about $3500. The windows are installed as solid sheets and ventilation is supplied through louvres placed beneath the windows.

PLASTICS IN AIRPLANES. Product Eng. *10*, 290–4 (July 1939). A review.

PLYWOOD STRUCTURES. O. H. Basquin. Aero Digest *35*, 43–4, 47 (July 1939). A discussion of the advantages of phenolic resin as a bond for aircraft plywood and of a new process for forming curved panels and fastening stiffening members to them in one operation.

LOW-DENSITY STRUCTURAL MATERIAL. V. E. Clark. Aero Digest *35*, 101–2, 105 (July 1939). The development of *Duramold* for aircraft construction and its properties and advantages are considered.

Testing

NEW PROCEDURE FOR ESTIMATING FLOW AND RATE OF HARDENING OF PLASTICS. A. Schwittmann. Kunststoffe *29*, 190–2 (July 1939).

DETERMINATION OF THE MOLDING PROPERTIES OF THERMOSETTING PLASTICS. M. Krahl. Kunst.-Tech. u. Kunst.-Anwend. *9*, 204–5 (June 1939). This and the preceding article describe apparatus for the measurement of flow, speed of hardening and "closing time" of molding powders.

MEASURING WATER VAPOR PERMEABILITY OF PLASTICS. W. Schröder. Kunststoffe. *29*, 44–5 (Feb. 1939). A test method and apparatus are presented for evaluating the permeability to water of wire-coating materials in tubular form.

TEST METHODS FOR ARTIFICIAL LEATHERS. K. Werner. Kunststoffe *29*, 105–7 (Apr. 1939). The measurement of tearing strength, stitch retention, folding endurance and gluing behavior are considered.

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EMULSION POLYMERIZATION. H. R. Dittmar (to E. I. du Pont de Nemours and Co.). U. S. 2,163,305, June 20. Making granular acrylate or methacrylate ester polymers by emulsifying the ester in water with the aid of starch or a starch ether, polymerizing, hydrolyzing the dispersing agent and separating the polymer from the aqueous medium.

AMIDE POLYMERS. W. H. Carothers and G. D. Graves (to E. I. du Pont de Nemours and Co.). U. S. 2,163,584, June 27. Condensing a diamine with a dicarboxylic acid in an aqueous medium, distilling off the water and polymerizing the product by heat.

LINEAR POLYMERS. E. W. Spanagel (to E.I. du Pont de Nemours and Co.). U. S. 2,163,636, June 27. Forming linear amide polymers by a condensation and polymerization reaction under pressure, in presence of sufficient water to liquefy the reaction mixture.

APPLICATOR. A. H. Jung (to Victor Metal Products Corp.). U. S. 2,164,244, June 27. A molded bottle cap which also serves as an applicator has the applicator stem terminating in a head which is molded into a recess in the center of the cap.

SAFETY GLASS. G. B. Watkins (to Libbey-Owens-Ford Glass Co.). U. S. 2,164,301, June 27. Laminated glass with a synthetic resin interlayer is joined under a high pressure and relatively low temperature; the pressure is then gradually lessened while the temperature is increased to effect firm, uniform adhesion.

FRICTION FACINGS. M. T. Harvey (to Harvel Corp.). U. S. 2,164,326, July 4. Brake linings and clutch or pulley facings are made from a powdered infusible phenolic resin and a binder of such properties and proportions as to provide constant heat conductivity and friction coefficient.

GASKETS. H. A. Winkelmann, E. W. Moffett and Wm. C. Calvert; H. A. Winkelmann (to Marbon Corp.). U. S. 2,164,367-8, July 4. Reacting rubber with hydrochloric acid gas to form a hydrochloride which is proof against solvents, oils and water; and making gaskets from rubber hydrochloride, asbestos and a basic heat stabilizer.

ELECTRIC CAPACITOR. F. M. Clark and R. A. Ruscetta (to General Electric Co.). U. S. 2,165,090, July 4. A low melting resin, suitable for use in capacitors, is made from lactic acid and ammonium lactate.

FRICTION FACINGS. M. T. Harvey (to Harvel Corp.). U. S. 2,165,140, July 4. A binder for friction facings, uniformly distributed through the facing to insure even wear, is made by impregnating the facing with cashew shell oil and condensing the oil with formaldehyde.

RESOL. H. Hönel (to Reichhold Chemicals). U. S. 2,165,380, July 11. Making resols by condensing formaldehyde with m-alkylphenols in which the alkyl group is propyl or higher.

THERMOPLASTIC MOLDS. J. S. Reid (to Thermo-Plastics, Inc.). U. S. 2,165,762, July 11. An improved gate for thermoplastic molds extends along the parting line of the mold sections, equal parts in each section, and connects the sprue with the cavity.

POLARIZING LIGHT. E. H. Land (to Polaroid Corp.). U. S. 2,165,973, July 11. Suspending herapathite crystals in a cellulose derivative medium on a supporting base, in order to polarize light passing through the medium; and forming a plurality of polarizing layers, each with a design, so that patterns may be formed by altering the vibration plane of light passing through the layers.

CREASEPROOFING FABRICS. H. Rein (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,166,325, July 18. Creaseproofing textiles by soaking in a liquid containing a wax, then treating the fabric with a synthetic resin.

SULPHIDE PLASTICS. R. Schröter and W. Becker (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,166,507, July 18. Making plastic products by reaction of water-soluble polysulphides with dihalogenated acetals, mercaptals or mercaptols.

CASEIN ARTICLES. J. A. Parsons (to American Plastics Corp.). U. S. 2,166,550, July 18. Stamping and preforming pieces from a sheet of cold uncured plasticized casein composition, and curing the pieces so made.

POLYSTYRENE VARNISH. S. M. Stoesser and A. R. Gabel (to Dow Chemical Co.). U. S. 2,166,557, July 18. Polystyrene coatings plasticized with beta-ethoxyethyleneglycol 2-chlorophenoxyacetate.

MOISTUREPROOF FOIL. N. F. Beach (to Eastman Kodak Co.). U. S. 2,166,711, July 18. Moistureproofing cellulose ester foils with a film of blended wax and gum.

ACETAL RESIN. K. G. Blaikie and R. N. Crozier (to Shawinigan Chemicals, Ltd.). U. S. 2,166,856, July 18. Blending a polyvinyl acetal resin with a condensation product formed from an aldehyde and p-tert.-amylphenol.

VINYL RESIN. A. Kirkpatrick (to Monsanto Chemical Co.). U. S. 2,166,955, July 25. Rendering the color of a vinyl acetal resin stable to light and heat by adding to the resin not more than 1% of an N-acyl-N-alkylcyclohexylamine.

OIL-SOLUBLE RESIN. V. H. Turkington and Wm. H. Butler (to Bakelite Corp.). U. S. 2,167,094, June 25. Condensing formaldehyde with a tar acid fraction boiling between 225 and 250° C. to form an oil-soluble resin which remains solid up to 80° C.

TREATED RAYON. Camille Dreyfus. U. S. 2,167,234, July 25. Making rayon slip-proof and run-proof by forming a fabric of rayon and animal fiber, treating with resin ingredients, and converting these ingredients to a water-insoluble resin.

MOLDING COMPOSITION. W. Röhrs (to Bakelite Corp.). U. S. 2,167,313, July 25. Compounding a heat-hardenable synthetic resin with at least its own weight of fluorite powder to form a product which yields moldings having good thermal and electrical insulating power.

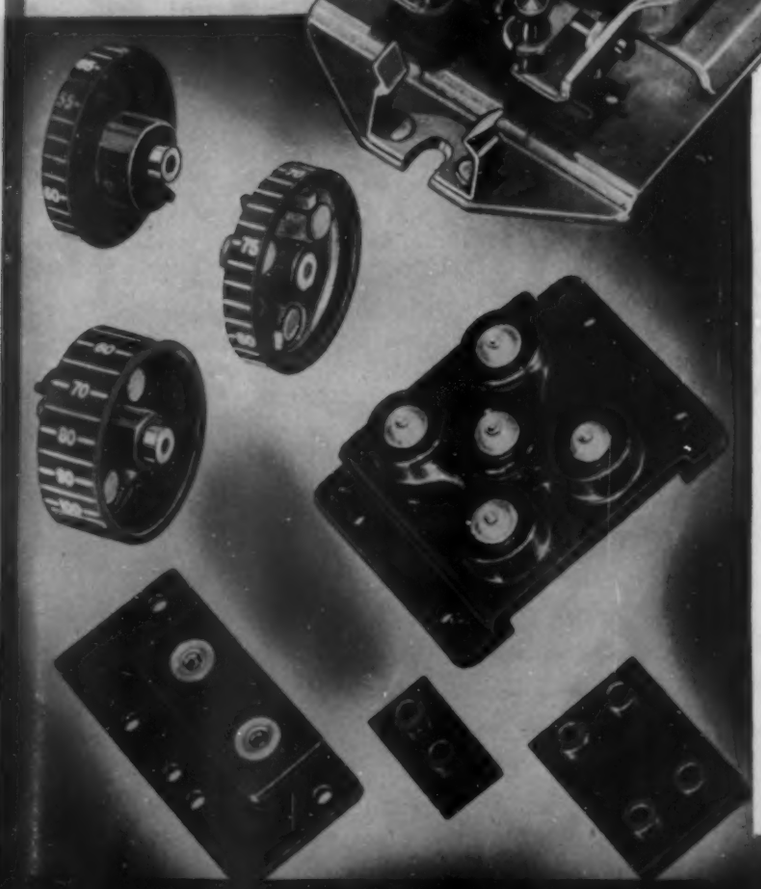
SHAPING POLYVINYL CHLORIDE. G. Wick. U. S. 2,167,441, July 25. Molding crude vinyl chloride resin without the aid of plasticizers or antioxidants, by pressing at about the normal depolymerization temperature.

CASEIN FOILS. H. Heckel (to Marbon Corp.). U. S. 2,167,570, July 25. Making thin transparent casein foil by casting a soluble caseinate and a hardening agent and passing the resulting sheet through an acid bath, then through glycerol.

NITROGENOUS RESIN. Leon Lilienfeld. U. S. 2,167,661, Aug. 1. Making water-soluble resins by condensing glycerol dichlorohydrin with ammonia.

IT'S MOLDED DURITE PARTS...

for These Precision Electrical Instruments



Because of its many ideal characteristics DURITE is used in the fabrication of various parts of electrical appliances and instruments. ◦ ◦ Julien P. Friez & Sons specify DURITE for the case and parts of their "Dual Blade Precision Thermostat"* which is but one of the complete line of temperature control devices manufactured by this well known concern. ◦ ◦ Today electrical, as well as a host of other manufacturers, realize the advantages of DURITE molded parts. Give your product the benefit of DURITE. Write to Durite Plastics, the exclusive producers of phenol-furfural resins.

*Molded by Consolidated Molded Products Corporation, Scranton, Penna.

DURITE PLASTICS

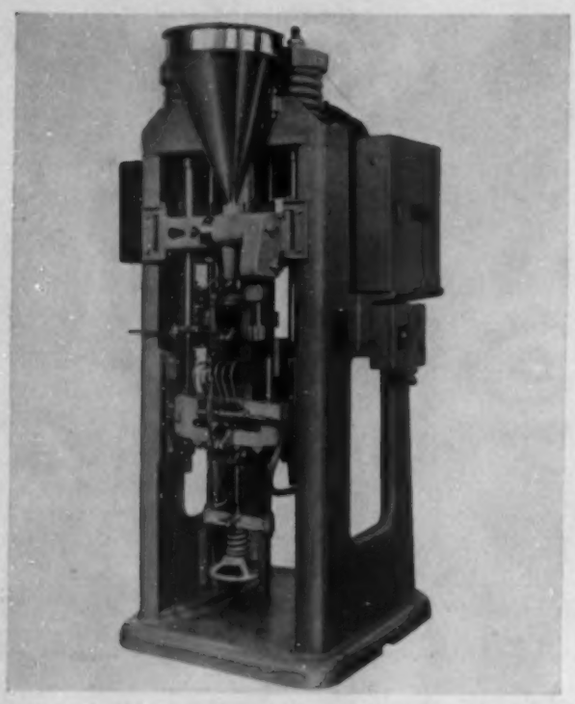
REG. U. S. PAT. OFF.

FRANKFORD STATION P. O.
PHILADELPHIA, PA.

Equipment

AN ENGINEERING ADVANCEMENT HAS RECENTLY BEEN made by the Chicago Metal Hose Corp. featuring the attachment of metal end fittings and end seals to metallic tubing by means of electric resistance welding. This development, designed principally for use with stainless steel tubing and stainless steel bellows, permits, it is claimed, the fabrication of completely sealed vacuum tight units free from soldered, brazed or torch welded joints of any kind.

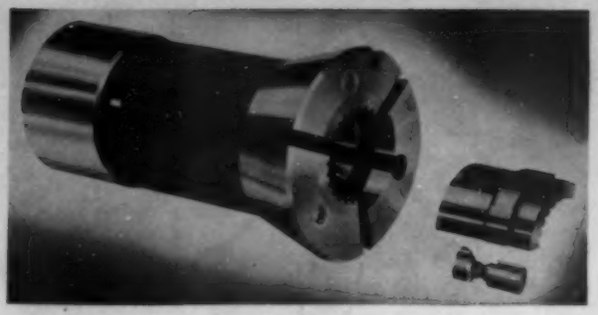
HAND-OPERATED "ATECO" $2^{7}/_{16}$ IN. DIAMETER EXTRUDING presses for laboratory and experimental work are announced by Aurelio Tanzi Engineering Co. An electric heater with rheostat for a temperature up to approximately 250 deg. F. or 121 deg. C. can be furnished and attached to the cylinder of the press.



A LARGER, 15-TON CAPACITY, 10-IN. STROKE, COMPLETELY automatic, self-contained machine for molding thermosetting plastics has been added to the line of F. J. Stokes Machine Co. (illustrated above). It is said to produce moldings requiring up to 18 tons pressure and mold parts up to 4 in. height, 6 in. length and 19 sq. in. projected area and features an adjustable bolster to reduce the length of ram travel increasing production rates on shallow work. It may be used on short-run operations as well as large quantity production.

THE PARTLOW CORP. ANNOUNCES A NEW TIME DELAY relay, used for automatically timing the duration of a purging cycle. It comprises a synchronous timing motor driving a gear train through a magnetically engaged clutch. At the end of the timing period, a switch operates to stop the timing motor and either connects or disconnects the load as desired. Upon breaking the timer circuit the magnetic clutch releases and the timer automatically resets itself. The timing is easily adjusted by setting the knob and pointer to the desired time on the calibrated scale. As the timing period elapses, the pointer travels over the scale and indicates the amount of the timing period remaining.

ULTRA-CHEX, A NEW SET OF NINE PRECISION MEASURING standards, has recently been placed on the market by George Scherr Co. The set may be used for checking lead accuracy of micrometers, inspecting and setting micrometers, setting height gages and adjustable snap gages, and setting and inspecting measuring machines and tools.



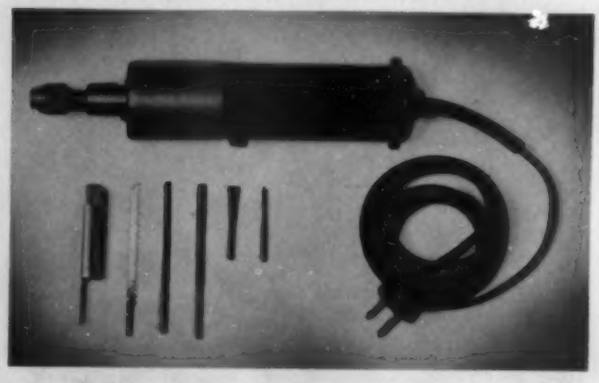
INTERCHANGEABLE NO-THREAD PAD CAN BE FITTED TO THE new Morrison Master Collet (illustrated above) without removing it from the spindle of automatic screw machines. An independent lock in a threaded double clamp is said to assure a firm dovetail grip on the pad, setting into position. A ground shoulder on the pad fits into a ground groove in the collet overcoming endwise movements.

OSCILLATING GRANULATOR, A NEW AND LARGER MACHINE of the automatic screen type has been developed by F. J. Stokes Machine Co., to be used for granulating dried crystal masses, processing filter-press cake both before and after drying, breaking down materials caked in storage, preparing wet mixtures for drying, breaking up compressed slugs for debulking operations and for similar operations.

DUST COLLECTORS IN TWO SIZES ARE MANUFACTURED BY Covel Manufacturing Co. Self-contained portable units collect, separate and store dust from one or two machines. Operation is by suction which draws dust through a flexible metal tube to centrifugal cyclone separator where heavy dust particles drop to the bottom. Fine dust collects inside a canvas bag. Both separator and bag are easily cleaned.

AN AUTOMATIC BUTTON INSPECTION MACHINE, WHICH CAN be used also for allied inspection work has been developed and patented by C. & M. Electric-Eye Co. Four buttons per second can be inspected for surface, thread holes, polish, burrs and are graded as to count, size, packaging, color. Based on the principle of a photo-electric cell and conveyor it is made to discard imperfect buttons without an operator. Its two parts, each 2 ft. by $2^{1}/_{2}$ ft. by $2^{1}/_{2}$ ft., weigh 300 pounds.

BALL BEARING, RUBBER ROLL, GLUE SPREADERS FOR LIQUID resins, casein and similar adhesives, equipped with sensitive and accurate micrometric adjustments for controlling glue film depth and applying an even coat to veneers of any quality, are new products of Black Bros. Co., Incorporated.



A NEW TOOL HAS BEEN DEVELOPED BY H. & H. RESEARCH Co., which has a reciprocating movement, to be used for taking off the last thousandths in special machine production, in die sinking, in pattern, tool and plastic mold making—work that has always been done by hand. Powered with a 110 volt universal motor, it chips, saws, files, burrs, hones, etc., developing a 6 to 16 lb. push at the end of the file, according to a recent release. Its substitution on close limits handwork is reported to be practical, because the push-button on the grip provides instantaneous control and the tool may be held so that the work is in full view at all times. (Shown above.)

National

BRILLIANT

RESIN COLORS

UNIFORM

A COMPLETE LINE OF COLORS
SPECIALLY MANUFACTURED
FOR PLASTIC COMPOUNDS

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WE INVITE YOUR PROBLEMS

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PROVIDENCE	CHARLOTTE	CHATTANOOGA
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Perhaps your ingenuity and ours may help you solve some product problem, just as ingenuity in the application of BEAD CHAIN* has done for many others.

BEAD CHAIN*, of glistening metal beads, forms a strong chain that cannot kink nor tangle. It is made of various metals (including Monel) in sizes from 3/32" to 3/8" diameter beads, with couplings and attachments to suit.

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Publications

Write for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices.

Industrial Plastics
by Herbert R. Simonds
Pitman Publishing Corp. 2 W. 45 St., New York, N. Y.
Price $4.50 **371 pages**

The author evidently has done much reading and research on the subject of plastics and has been ably assisted in the work by many authorities. The foreword, written by Carleton Ellis, author of *The Chemistry of Synthetic Resins*, proclaims it a truly comprehensive and practical book.

There is no doubt that it contains a wealth of information gathered largely from readily available sources of published material. Arrangement is a bit confusing but with patience, almost any phase of plastic manufacture or production will be found mentioned with varying degrees of detail. Generous credit is given to trade names, companies and individuals who have helped the author in compiling the material.

The Soybean Industry, 2nd Edition
by A. A. Horvath
Chemical Publishing Co., Inc., 148 Lafayette St. New York, N. Y.
Price $4.00 **221 pages**

This book was prepared to supply a concise and authoritative source of information on this farm product which has received considerable attention during the past few years from the chemurgic group. The composition and processing of the bean and the utilization of the various products obtained from it are covered in 20 chapters. The chapter on soybean plastics reviews the work of Satow and the Ford Motor Co. in this field. A bibliography of 70 papers and publications provides a convenient guide for obtaining more detailed data on special phases of the industry. G. M. K.

Tested Public Speaking
by Elmer Wheeler
Published by Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y.
Price $2.00 **173 pages**

The author, who has addressed more than a million people during the past few years, gives generously from his experiences to help readers act naturally, speak forcefully, get attention and hold it, when called upon to address an audience. He tells how to put the "sizzle" into a talk which makes it "click." Subject, preparation, presentation, behavior, showmanship, awkwardness and many other things are discussed in rapidly running order to help an orator handle any situation that pops up. A self-starter for anyone who has to talk. E. F. L.

THE CONSUMER MARKET DATA HANDBOOK, RELEASED BY the Bureau of Foreign and Domestic Commerce, is a 464-page study containing market facts for each city of more than 2500 population and for every county in the United States. Of particular interest to chemical and related product industries are the sections which deal with the number of drug stores in the country, the volume of drug store sales in each community and the index of the volume of drug sales in relation to total sales. Copies at $1.75 may be obtained from the Superintendent of Public Documents, Washington, D. C., or any District or Cooperative office.

HANSON-VAN WINKLE-MUNNING CO., MATAWAN, N. J., manufacturer of electroplating equipment and supplies, has issued a complete detailed treatise on its new type of equipment for producing low-voltage, direct current for electrodeposition. It describes the principle of copper-oxide rectification, the construction of the complete rectifier, its operating characteristics, its applications and advantages.

WORLD CHEMICAL DEVELOPMENTS IN 1938, A 200-PAGE study by C. C. Concammon, Chief, and A. H. Swift, Chemical Division, has just been released by the Bureau of Foreign and Domestic Commerce. It points out the irregularities and uncertainties for the chemical producing countries of the world, cites trade regulations, labor and wages, new products, and gives detailed schedules of production throughout the world. Available from the Superintendent of Documents, Washington, D. C., for twenty-five cents.

PRACTICAL METHODS OF MACHINING BAKELITE-LAMINATED and How to Apply Them in Your Own Shop is the title of a new folder issued by the Synthane Corp., Oaks, Pa. Instructions for machining laminates are given in the form of a condensed chart suitable for hanging on the wall. Many illustrations show how various machining operations are done at the plant. Of additional interest to readers is a brief comparison of the circumstances under which the material should be machined by the purchaser or prefabricated by the company.

LAKE ERIE ENGINEERING CORP., BUFFALO, N. Y., HAS ISSUED an informative bulletin giving questions and answers covering the use of rubber printing plates as well as selection of vulcanizing presses.

STOCK MOLDED KNOBS AND FITTINGS FOR ALL PURPOSES, manufactured by Evered & Co., Ltd., Surrey Works, Smethwick, Staffordshire, England, are illustrated and described in a folder issued by the company.

THE EDGE MOOR IRON WORKS, INC., NEW YORK, N.Y., HAS made available a new bulletin covering descriptions and engineering data on Edge Moor Low Head Boilers. The bulletin includes full engineering tables listing standard boilers with specifications.

CATALOG FOLDER, ISSUED BY THE MILLER CO., MERIDEN, Conn., covers their new line of flood and concentrating three-light units, 48 in. fluorescent daylight reflectors, Miller-Ivanhoe reflectors with junction box, and other industrial lighting fixtures.

COMPLETE INFORMATION ON AMERICAN ASSEMBLED TYPE "Dustube" Dust Collectors is now available in a new illustrated circular just published by the American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.

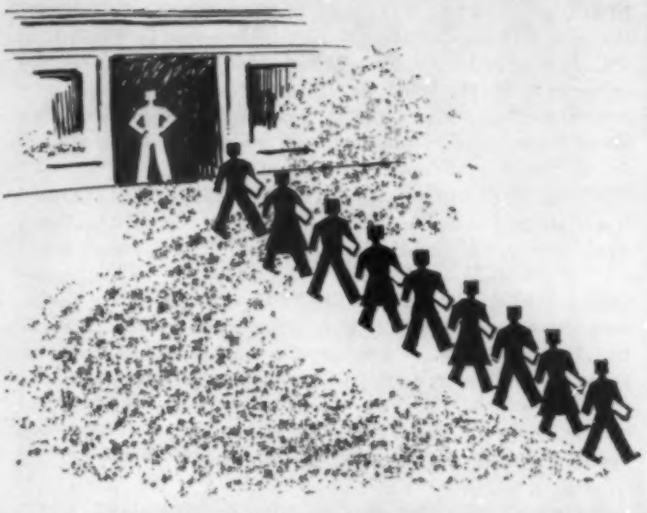
A NEW FOLDER DESCRIBING THE USE OF CARPENTER CENtrifugal driers in all industries where there are granular materials to be dried, has been issued by Koppers-Rheolaveur Co., Pittsburgh, Pa. The company also has issued a leaflet about Koppers wedgewire screens for the removal of free moisture from fine material. Features claimed for the Carpenter driers include: Maximum moisture removal; large capacity; continuous feed, which reduces power costs; low maintenance cost through simplicity and quality of construction. Wedge-wire screens are made of a variety of metals and in a number of surface patterns to meet specific requirements.

THE FIRST ISSUE OF *PLASTICS PROGRESS*, A NEW 8-PAGE illustrated monthly bulletin, giving information of interest to actual and possible users of plastic molded parts, has been published by Chicago Molded Products Corp., 1023 North Kolmar Ave., Chicago, Illinois.

SPIREC TWIST DRILLS FOR TINY HOLES ARE DESCRIBED AND listed along with conversion tables, in a recent bulletin from R. Y. Ferner Co., Boston, Mass., agents for U. S. and Canada. They are flat twisted drills, with wide flutes for easy escape of swarf and ground circumference for accuracy of drill and holes.

CHEMICALS BY GLYCO, A COMPREHENSIVE CATALOG OF specialty chemicals covering emulsifying agents, glycol and glyceryl esters, synthetic waxes, synthetic resins, plasticizers and flexibilizers, has been revised and brought up to date by the Glyco Products Co., Inc., 148 Lafayette St., New York, N.Y.

The Picture on the Cover often Sells the Magazine



All other things being equal—quality, price and service rendered—the article that attracts the eye also attracts the customer's dollar. . . . If your product, or a part of it, can be molded; if you want to lift it out of the commonplace in appearance—as well as potential profit—then you'll want to put the job up to STOKES designers. We offer you specialized experience in designing that will stimulate sales—whether starting from scratch or consultation with your own staff.

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MOLDERS OF ALL PLASTICS—Including Hard Rubber—SINCE 1897

GROTELITE

Maintains a Staff of Specialists on Injection Molding

Also a Fully Equipped Injection Molding Laboratory

Both are available to manufacturers for solving molding problems, and for the actual testing of molds on short production runs to secure accurate cost and other data.

GROTELITE COMPANY, Inc.

Pioneer Builders of Injection Presses

BELLEVUE, KENTUCKY

NEWS

THE WESTERN SECTION OF THE SOCIETY OF THE PLASTICS industry will again convene this year at the Spink Wawasee Hotel and Country Club, Lake Wawasee, Ind., September 10–12. Please note the correction as this was previously announced (in *Voice*) as August 6–8, but has been postponed to the September dating. Lake Wawasee is located 30 miles east of South Bend, 38 miles north of Fort Wayne and 2 miles south off Route 6. Large signs mark the entrance to the hotel.

The banquet dinner will be held on the evening of the 11th at which time any matters of interest and discussions will be held at an open session. Allan Fritzsche, chairman of the board of directors, will be in charge of the meeting.

STOCKHOLDERS OF GENERAL PLASTICS, INC., VOTED AUGUST 30 on a plan to consolidate the company with the newly formed Durez Plastics & Chemicals, Inc., incorporated in New York State to manufacture and sell plastics and chemicals. General Plastics was organized in 1926 and is the second oldest manufacturer of phenolic resins and hot-press molding compounds in the United States. Its products sold under the trade name, *Durez*, have secured world-wide acceptance and the company's growth has been outstanding even in the fast-moving chemical industry. The new Durez Plastics incorporates in its name the trade name *Durez* under which General Plastics' products have been sold. There will be no change in the management and no change in the assets as far as equities for stockholders are concerned.

AT A MEETING HELD TUESDAY, AUGUST 29, 1939, THE Board of Directors of Union Carbide and Carbon Corp. approved an agreement for the acquisition by Carbide of all the assets of Bakelite Corp. Carbide is a producer of chemical raw materials and Bakelite a user of chemicals in its converting activities. The consummation of the agreement will bring valuable supplementary facilities to both organizations. The coordination of technical knowledge, research, production methods, and distribution facilities of these two organizations will result in the improvement of existing products, the development of new plastics and other chemical compounds, and the discovery of new uses for such materials.

Bakelite Corp. has been active in the manufacture and distribution of thermosetting plastics, principally of phenolic types. Over a quarter century ago Dr. L. H. Baekeland made his discovery which gave to the world a new material. This he called *Bakelite* plastic. During the intervening period products from this material have become well and favorably known in such forms as telephone receivers, automobile ignition parts, timing gears, radio cabinets, electric insulators, switch plates, bottle caps, lamp bases, pencils, buttons and novelties.

During recent years an increasing number of Carbide's synthetic organic chemicals have been used as raw materials in various plastics, including those made by Bakelite. Carbide also produces vinyl resins, recent developments being *Vinylite* resin for the laminating interlayer in the new high-test safety glass, and *Vinyon* for the production of synthetic yarn. As a producer of raw materials needed for making plastics, Carbide is taking a natural step in the diversification of its synthetic organic chemical business through the addition of the complementary lines of Bakelite products.

Under the agreement there will be distributed to Bakelite stockholders 187,500 shares of Carbide common stock exchanged for Bakelite's assets. Bakelite preferred stockholders will be entitled to receive for each preferred share $1\frac{1}{4}$ shares of Carbide stock, the remainder of the Carbide stock to be divided ratably among the Bakelite common stockholders. The agreement will become effective upon ratification by the holders of each class of Bakelite stock.

There will be no change in Bakelite Corp. personnel and the organization will continue to do business at the same old spot—247 Park Ave., New York, N. Y.

MODERN PLASTICS COMPETITION CLOSES ON SEPTEMBER 23. All entries must be in our office on that date in order to classify and mark them for the judging which takes place immediately after. Hundreds of entries are already here and we urge you to get yours in at the earliest possible moment.

HERCULES POWDER CO. HAS PLACED DR. EMIL OTT IN charge of all company research, with headquarters in Wilmington, Del. In this position, Dr. Ott will work closely with those consuming industries which can utilize the facilities of the Hercules Experiment Station, generally considered one of finest chemical laboratories in the United States. O. A. Pickett continues as director of the station.

GENERAL ELECTRIC CO. ANNOUNCES THAT JACK QUILLMAN is now attached to the Plastics Dept., New York office, 570 Lexington Ave., where he will specialize in Plastics Packaging as a distinct line.

THREE FLOORS OF GRAND CENTRAL PALACE, NEW YORK, have been reserved for the Seventeenth Exposition of Chemical Industries, December 4 to 9. Exhibit classifications will include chemicals, chemical products, laboratory equipment and supplies, instruments of precision, materials handling equipment, brewing, distilling and bottling equipment, industrial chemical machinery and materials, containers and packaging machinery and materials of construction.

THE FIRM OF DOWDING & DOLL, LTD., GREYCOAT ST., WESTminister, London, has been appointed as distributor for the Lester die-casting and plastic injection molding machines for European distribution. The company also has taken space at the machinery exhibit to be held at the Olympia Exhibition in London, from September 14 to 30. In cooperation with its new distributor, the Phoenix Machine Co. will have on exhibition one of its new HHP-1 die-casting machines, as well as the latest type Lester No. 2B 6-oz. injection molding machine.

HASLER-TEL CO., AFTER MORE THAN FIFTEEN YEARS at 461 Eighth Ave., has given notice of its recent removal to the Underwood Building, 30 Vesey St., New York.

THE FALL MEETING OF THE SOCIETY OF THE PLASTICS Industry will be held on October 1, 2 and 3, at Westchester Country Club, Rye, N. Y. It is requested by the committee in charge that everyone gather at the Club on Sunday afternoon. A business meeting will be held at 9 A. M. and the official dinner is scheduled for Monday evening at 7 P. M. Registrations ($3.00) should be mailed to George Scribner at Boonton, N. J.

THE FORMATION OF THE EAGLE PLASTICS CORP., COMPRESsion molding company, is reported by E. R. Heckman, executive vice-president and general manager. Its plant will be located at 135 Walton St., Brooklyn, N. Y.

A. KNOEDLER CO., LANCASTER, PA., HAS DEVELOPED A CAST resin with new metallic color effects, not heretofore produced in this country. Beautiful gold and silver stone effects and imitations of Tiger-Eye can be made, it is claimed. Patent application has been filed on this new process.

CHIKSAN TOOL CO. HAS MOVED TO ITS OWN OFFICE BUILDing at Brea, Calif., and will shortly establish its manufacturing equipment in the factory adjacent. Crane Co., Chicago, Ill., has been appointed national distributor for the company.

NYLON MONOFILAMENT IS NOW BEING USED TO MAKE surgical sutures. This material, that will enter into fine hosiery, is a man-made, protein-like substance derived basically from coal, air and water, characterized by extreme toughness and strength, and possessing the peculiar ability to be formed into fibers and into various shapes such as bristles and sheets. It is said that these sutures are practically non-irritating to the tissues, do not deteriorate in the presence of infection, and because the filament is non-capillary, the possibility of infec-

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Last Opportunity

To Enter Your Product in the 1939 MODERN PLASTICS COMPETITION

All Entries Must Be Received by SEPTEMBER 23rd!

"DIVIDENDS" AND HONORS

All entries—win or lose—are exhibited before national buyers.

The Winners—in each of 11 classifications—receive powerful sales "dividends": national and international publicity and film showings.

NO FEES! NO OBLIGATIONS OF ANY KIND!

Anyone may enter. Enter as many products as you wish, made partly or wholly of Plastics, which have been designed or put on the market since Sept. 1, 1938.

Use Official Entry Blank in May issue of MODERN PLASTICS. Or write for additional entry blanks.

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Sponsored by

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122 E. 42nd Street New York, N. Y.

3 steps

Norwich Pharmacal Co.'s three-step black Bakelite display, molded by Auburn Button Works, has a double significance to sales minded merchandisers.

Not only do the three steps of this unique counter display form an interest-centering setting for three varying size bottles of Pepto-Bismol. They symbolize, also, the three vital steps to be considered in the use of molded plastics—in all three of which Auburn's more than 60 years of pioneering experience becomes of invaluable benefit to the purchaser of molded plastics.

In DESIGN, the suggestions of Auburn engineers, drawing upon their experience, often lead to substantial savings. In the MOLD MAKING, the craftsmanship and long experience of Auburn workmen again tell. Finally in actual MOLDING, Auburn care, knowledge of cost-cutting shortcuts that cannot impair quality, and numerous rigid inspections, insure the qualities that help boost sales. Why not let an Auburn engineer tell you the whole story.

Established 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N. Y.

tion penetrating the suture and being carried into the wound is diminished. Because of the smooth surface of nylon, there is less discomfort in removing the suture from the tissue. The sutures are fast dyed, and aid the doctor in locating the surgical stitch readily.

A STATE SPONSORED COURSE IN THE INDUSTRIAL CHEMistry of Plastics, consisting of 16 weekly meetings from 7:30 to 9 P. M., will begin Wednesday, November 8, at the Massachusetts Institute of Technology. It will be open to anyone interested, at a nominal fee, but will be particularly valuable to those engaged in the plastics and related industries. Those interested may enroll at the first meeting of the class or previously, by writing to the Division of University Extension, Massachusetts Department of Education, Boston, Mass.

THE PHOENIX MACHINE CO. REPORTS THAT DURING THE National Machine Tool Show, October 4–13, in Cleveland, it will have on exhibition at the Central Armory one of its HHP-3X Aluminum machines, as well as a Lester injection molding machine. The George Scherr Co., Inc., 128 Lafayette St., New York, will also take part in the show with a large exhibit in two departments, one showing various machine tools in operation, the other devoted to precision measuring and inspection equipment.

IMPORTANT MODIFICATIONS ARE TO BE MADE, ACCORDING to an announcement from the Headquarters of the American Society for Testing Materials, in the methods of publishing the Society's standard specifications and tests, effective November 1939. The major change is to combine the Book of Standards (issued triennially) and the Book of Tentative Standards (issued annually). These changes which also embody numerous advantages are necessary because of the great growth of A.S.T.M. standardization work.

The new method of publication will be to issue the standards and tentative standards collectively in one triennial publication, divided into three parts. Publication of new and revised tentative standards in the annual *Proceedings*, Part I, will be discontinued; the *Proceedings* including both committee reports and papers (about 1300 pages double-column format) will be bound in one volume. The publication of the annual Book of Tentative Standards will be discontinued entirely.

JOHN A. BAUER, FOR SEVERAL YEARS IN CHARGE OF THE New York office of Hanson-Van Winkle-Munning Co., manufacturer of electroplating equipment and supplies, has been transferred to Matawan, N. J., to assist L. M. Hauge, vice-president in charge of sales. Irving A. Gemmel moves from the Engineering Department at Matawan to New York. Charles L. Anger has joined the company's sales staff and will be located in the Detroit office, 2842 W. Grand Blvd. Carl F. Miller & Co., 1033 6th Ave., South, Seattle, has been appointed distributor for the state of Washington.

W. ERNEST HENRY, SUPERINTENDENT AT HERCULES POWDER Co.'s chemical cotton plant, Hopewell, Va., has assumed the duties formerly carried out by Luke H. Sperry, manager, recently made chief engineer with headquarters at Wilmington, Del.

HUGH R. McKEAN, SINCE 1933 ASSISTANT SUPERVISOR OF cost for General Electric Co., has been appointed operating manager, in direct charge of engineering and manufacturing of the company's Plastics Dept., Pittsfield, Mass.

GATHERINGS OF BUSINESS EXECUTIVES, STUDENTS, ENGIneers and designers can be delightfully entertained for twenty minutes by a showing of the sound and color film, *Modern Plastics Preferred*, which is available without cost through the Publicity Department of the magazine. This film, devoid of all propaganda, reveals the source of plastic materials, follows them through various stages of their fabrication into commercial products, and finally, pictures the most unusual and effective application of plastics as represented by the winners in our last Modern Plastics Competition. Educational as well as entertaining, this film is open for Fall bookings. Write for open dates and incidental information to Publicity Director, Modern Plastics, 122 East 42nd St., New York, N. Y.

PLASTICS AT BOSTON A. C. S. MEETING

(*Continued from page 46*)

NATURE AND CONSTITUTION OF SHELLAC: SHELLOLIC ACID AND SIMILAR ACIDS. P. M. Kirk, P. E. Spoerri and W. H. Gardner. Shellolic acid, although a relatively minor constituent of the components of lac-resin, is of particular interest in any consideration of the nature of lac and the biochemical reactions which take place during synthesis of this resin by the lac-insect. This paper describes how shellolic acid, first reported by Harries and Nagel in 1922, and five similar crystalline acids were obtained from different lacs. It would appear that the lacollic lactone described by Weinberger and Gardner consisted of a mixture of these acids. Shellolic acid and three of the other acids had 15 carbon atoms; the remaining two acids had 16 carbon atoms. No evidence was obtained of the presence of lactones in the acid mixtures, although one acid yielded a lactone-ester upon esterification. All these acids appear to have hydroaromatic, cyclic structures and two hydroxyl groups. A preliminary study of the Curtius degradation of shellolic acid indicated that it cannot have the structure recently assigned to it by Nagel and Mertens.

PRELIMINARY STUDY OF THE CATALYTIC HYDROGENATION OF SHELLAC BY RANEY NICKEL. G. B. L. Smith and A. Smith. At least one component of shellac is alleged to have an unsaturated bond, and the iodine number of shellac is an important analytical constant. Accordingly, we may expect that shellac will absorb hydrogen under the influence of a catalyst. At room temperature and atmospheric pressure, the maximum total absorptions of hydrogen in 100 minutes using Raney nickel with TN Orange shellac, seedlac, bleached shellac and WW Gum rosin were 624, 688, 585 and 495 ml., respectively. If 1000 is assumed for the molecular weight of shellac and 304 for rosin, the maximum absorptions were 3.07 mols H_2 per mol of shellac and 0.79 mol H_2 per mol of rosin. Aleuritic acid cannot be hydrogenated by this method.

CHEMICAL EXAMINATION OF UREA COATING RESINS. J. J. Levenson, Jr. The method employed involved decomposition of butanol-urea-formaldehyde resins, oxidation of the aldehyde or alcohol, and titration of the resulting fatty acid. Control tests indicated a precision of about 1 part per 100. The analyses showed that the early stages of curing proceed largely through loss of water, although butanol and formaldehyde are also lost. During the latter stages of curing, loss of butanol and formaldehyde predominates, the magnitude of the losses varying considerably for different resins. The loss of butanol is generally greater than that of formaldehyde, but there does not appear to be any particular relation betwen the two. Despite the considerable losses, the butanol content of highly cured resins remains surprisingly high (25 to 32 percent of the cured resin).

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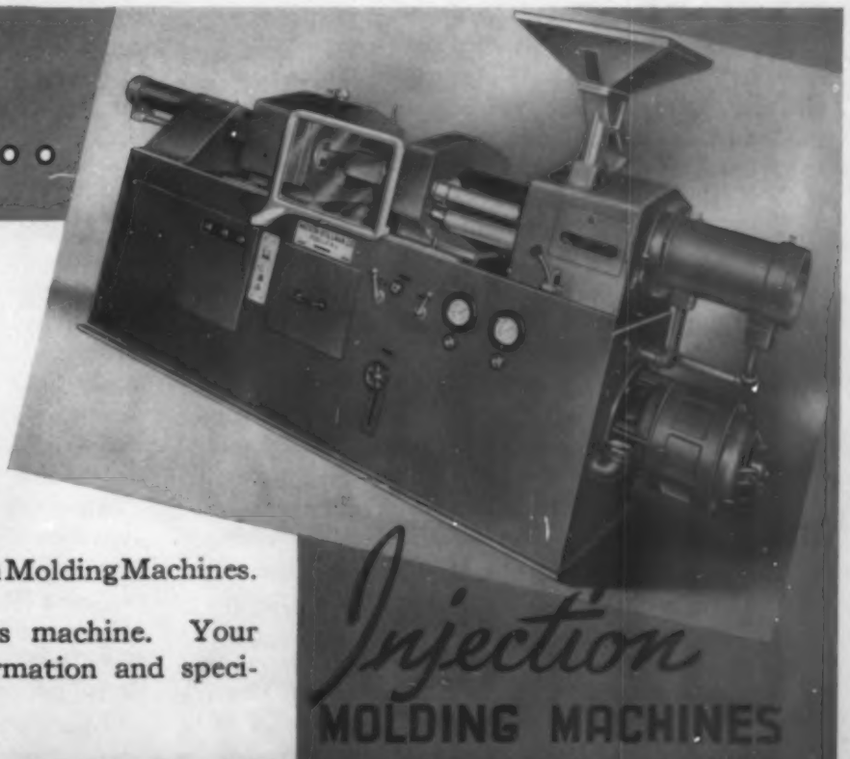

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9

10

In the State of North Carolina exhibit at the New York World's Fair, beautifully carved Plexiglas sheets, lighted from behind by fluorescent lamps, depict the arrival of English settlers at Roanoke Island in 1585 (Fig. 9), and the baptising of Virginia Dare (Fig. 10), first child born of English parents in America

ADVERTISING DISPLAYS

(*Continued from page 27*) lightly to remove grindings while working, as even chips of the methacrylate will scratch the surface. If used with edge-lighting these minute scratches are very disturbing.

Bending the plastic sheets into curved shapes is not difficult. A wood form is made and covered with a soft cloth, stretched over all parts which are to come in contact with the plastic. Boiling water or dry heat seems to work equally well. An oven may be constructed of plywood lined with asbestos and heated with regular electric heating units. Sheets for bending are suspended with clamps under the removable cover. In the absence of this equipment the writer has occasionally used the local baker's oven which was kept at about 450 deg. F. The plastic sheet was put into the oven lying flat on a board covered with soft cloth. After two minutes it was removed and was soft enough to almost drape itself over the form. In this way we have made curved showcases quickly where the advantages of methacrylate over glass are lighter weight and unbreakability, besides not having to wait several days for specially bent glass. The material cools quickly under cold water and may be trimmed to fit after forming.

In the exhibit we constructed for a gas association it was desired to feature a giant gas flame as the theme, dramatizing economy, silence, cleanliness, ease of installation, etc. The design and details were worked out in a model form, 18 in. high, which aided materially in selling the idea. This feature occupies the center aisle space and is visible down the length of the aisle. The flame itself is 9 ft. high. For the model we used sheet acetate $1/16$ in. thick which was cut to shape, cemented together, and sprayed with transparent lacquers in the actual flame colors, after consulting with gas engineers on the structure and coloring of several types of flames. This is flood-lighted from the bottom. Around the circular base are eight demonstrations of the various advantages of gas. The final flame is constructed of $1/4$ in. sheet methyl methacrylate in preference to plate glass because the danger of breakage is eliminated. For the larger plate it was necessary to piece the sections together with butt joints due to limited sizes of sheets available. These joints were made as previously described, then all edges cleaned and polished. Before assembly the parts were sprayed with transparent lacquer the same as the model.

The eight circular openings are also interesting. After appropriate designs were made and approved, they were executed in rear-lighted transparencies. A plate on $1/4$ in. acrylic plastic was placed in front of each transparency, carrying a carved line drawing, or appropriate copy flasher operated illumination of the transparencies is alternated with edge-lighting of the plates.

In contrast to the above, for a drug company we made a novel container for display of a precious liquid vitamin. Two pieces of 1 in. square methyl methacrylate rod were cut, one 4 in. long and the other 8 in. A $1/2$ in. diameter hole was drilled into the end of the long piece to a depth of $3/4$ in. After polishing this hole the vitamin was poured in and the pieces of plastic cemented together to seal the hole so that they formed a solid piece 12 in. long. After careful polishing of the joint the container was displayed vertically on a wood base, inside a circular showcase of bent methacrylate.

In the State of North Carolina exhibit there are four beautiful examples of carved acrylic sheets with edge-lighting. Some deal with the colonization of the terri-

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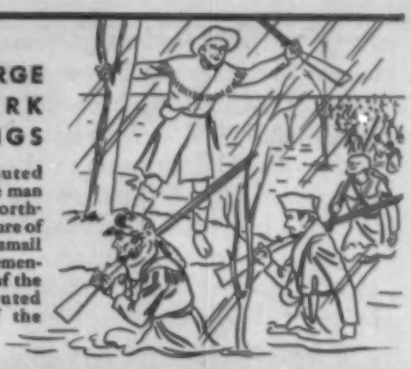

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tory (Figs. 9–10), and are displayed in a special case against a black velvet background. Fig. 11 shows the airplane flight of the Wright brothers at Kitty Hawk in a photograph behind an edge-lighted plastic plate which carries a carved line drawing showing a flight of modern planes passing the monument erected to immortalize their feat. One 18 in. fluorescent lamp was used to edge-light each of these works of art.

A manufacturer of concentrated coffee is using several displays with beautiful examples of carved methacrylate with edge-lighting to show the advantages of his product.

The Treasury Department of the U. S. Government has an exhibit showing distribution of funds to various divisions of the government. In this exhibit we used carved methacrylate "silver dollars" in various sizes from 2 in. to about 10 in. diameter. These were edge-lighted and the larger sizes were used in front of small scenes depicting operations in the different divisions.

A similar system was used in an exhibit showing the food supply of Manhattan and what would happen in the event of strikes, floods, and other catastrophes causing food shortage. In this instance we used a fine mesh wire screen to create the illusion, with edge-lighted plastic plates to contrast the working and well fed Manhattanites with the miserable men that might be.

We have often used acrylic rods and sheets in clear and in colors to transmit light to any given spot, as in placing emphasis on certain areas of maps, etc. These plastics are also excellent for letters and signs and can be mirrored and sand-blasted.

There are several other members of the plastics family which are better known to the display business through longer usage. The amount of light passed by translucent laminates makes this material ideal for translucent surfaces. It is also lightweight, strong, and inexpensive. It warps very little, which from a display viewpoint is one of the most important considerations. Tubes of similar material in colors and ivory are very decorative when lighted to bring out their translucence.

Cast resins have been used by the writer for gears and other machine parts to form a decorative demonstration of some particular operation. A manufacturer of electrical contacts using precious metals wanted to show his product in operation. A flasher was designed in which we used colored cast phenolic for the cams which operate the contact points, while supporting parts of clear methacrylate make it possible to examine the operation. The flasher actually operates a miniature electric sign in the upper part of the display.

Cut out letters and designs of cast resin have a warm translucent quality which is very attractive. It should be remembered in using any plastics of this type that they should be kept away from heat and must always have a free circulation of air around them.

The value of laminated material for display counter tops and kick plates where long wearing qualities are important is well known. This material is also available in thin sheets with a cloth backing for ease in application on curved surfaces. Metal inlays and combinations of colors make these plastics ideal for certain permanent installations of walls, furniture, etc.

Cellulose acetates are ideal for certain display uses. Here again the tendency to warp must be considered and provided for in their application. There have been disastrous examples of fine architectural and other models being distorted while on display due to excessive heat and lack of ventilation. However, the writer has used these materials extensively in various kinds of models and they are exceptionally easy to cut, assemble, and finish. For instance, glass brick walls, windows, doors, etc., are faithfully represented by making cuts in mat finish sheet acetate on a circular saw.

The *fluorescent plastics*, a variety of cellulose acetate are very decorative when cut-out and carved, similar to the way we have treated methacrylate. Recently Saks Fifth Avenue featured this material in window displays (Figs. 5–8). It has a peculiar light-collecting quality which gives it almost the effect of fluorescent colors under

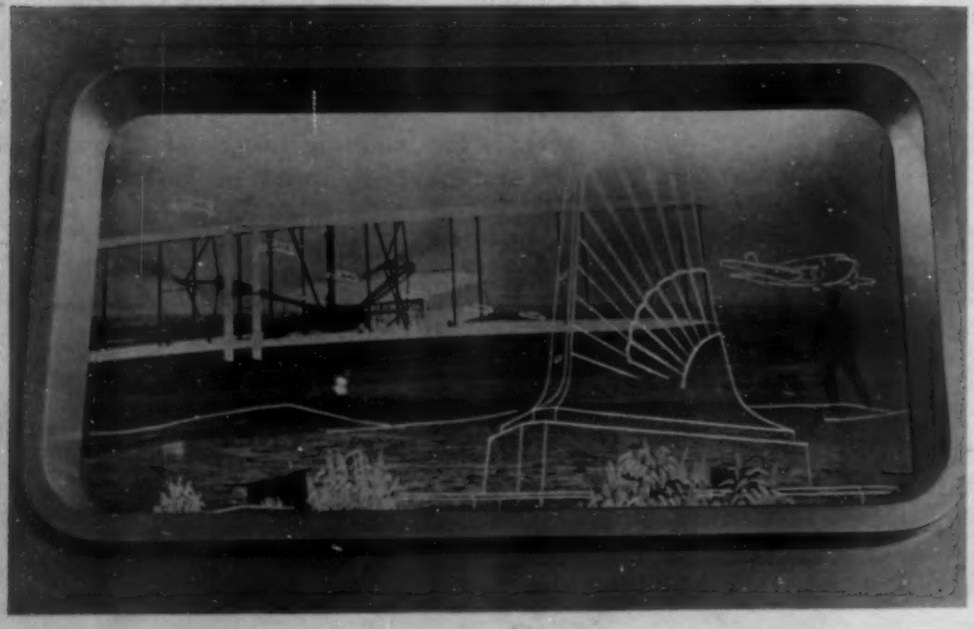

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Fig. 11—Epic flight of the Wright Brothers is dramatized in the State of North Carolina exhibit by a photograph set behind an edge-lighted Plexiglas plate, carved to show modern planes passing a monument commemorating that historic feat

MUSIC WHILE YOU RIDE

Push the tuning button or turn the knob of today's automobile radio and the chances are your fingers touch a plastic part molded by Kurz-Kasch. Perhaps you never gave these moldings a second's thought . . . but there they are, a typical example of the many ways Kurz-Kasch is serving modern industry.

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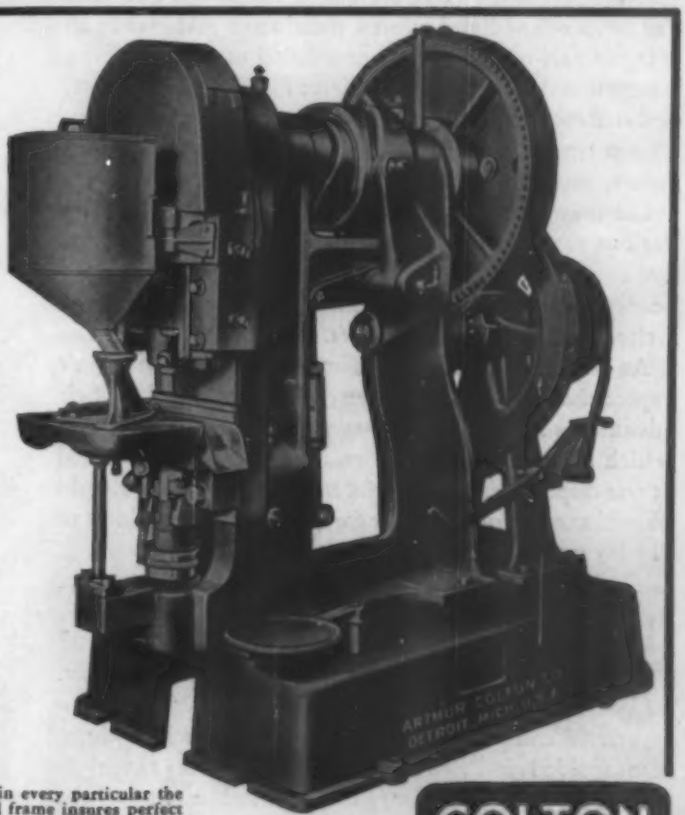
Other motor car manufacturers, including General Motors and Chrysler, as well as many other industries such as General Electric, National Carbon, Colt Patent Fire Arms, Otis Elevator, Moraine Products (they have twenty-four machines), use this same type and size machine in their plants for similar work.

When visiting the Fair see this machine running, notice its smooth, silent operation, without strain or laboring. Possibly you need such a machine in your plant. Let us tell you more about it.



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ultra-violet light, except that any source or quality of light is sufficient for the purpose (See pages 26 and 27).

Construction of the backgrounds for Saks Fifth Avenue presented a number of new technical problems, since the material used was made in 20 in. by 50 in. sheets, approximately 1/4 in. thick, and yet the finished window backgrounds had to give the appearance of being made in one piece, despite the fact that they were over 12 ft. in height and up to 5 ft in diameter.

The scrolling, carving, and etching of the pieces were entirely completed before assembly of each background was started. Special cements were used to join the edges and overlaps and then additional carving was added to conceal the joints.

The fiery glow of the carved surfaces was found to be most pronounced when the grooving was done with a cutting tool which left a right angle trough to emit the activated light passing through the plastic. Fine graduations in tone were attained by varying both the depth and the thickness of the carved lines.

This type of plastics is also being used for cut-out letters and etched counter signs where its brilliance is particularly effective. Merchandise display fixtures, as well as atmosphere pieces, such as Christmas wreaths and Santa Claus masks (Fig. 8, page 27) for columns and walls, are being made of the same material.

Display heads, figures, and other shapes have been made by applying thin sheet acetate in small pieces over a form and removing when dry. A softening agent such as acetone is used as an adhesive between layers.

A product using clear acetate in sheets with parallel *fins* or *louvers* of light colored translucent material as an integral part of the sheet is now being used for lighting where it is desirable to have direct light on the product, and still have the light diffused from the spectators' view. This material is available in sheets of various patterns, colors, and thicknesses.

Laminated cellophane has also been used in forming various shapes. Crepe cellophane, scotch tape in clear and colors, cellophane grass mats and fabrics of striking beauty and various weaves have all been used by the writer, with satisfactory results.

As a final word of caution to all display men: don't expect the impossible from any plastic material. Their advantages are many, but they all have their limitations which must be given consideration. Science has placed at our disposal these beautiful materials and they should be used at every opportunity to help raise the standards of display work to new levels.

NOW YOU CAN HEAR

(*Continued from page 28*) has 14 molded plastic parts. Largest of these is the battery case, molded in two pieces. Smallest parts are the miniature switch plugs, also molded in two pieces. These parts range in size from 3 1/2 in. by 2 1/2 in. for a half section of the battery case to 5/16 in. by 1/8 in. by 3/32 in. for the smallest part of the switch plug. Yet every piece is a precision job. Minute guide ribs, small bosses, connector plug

Radioear "Masterpiece" ear receiver, intensifier back plate and housing, and tiny switch plugs are shown above

holes, must not vary. Small brass inserts must be securely molded-in, all fitting closely.

However, fully as important as precision specifications in a unit for this purpose are several other factors. Finish is vital. Parts of the unit are in constant contact with the wearer's body. The satin smoothness of the plastic part as it comes from the mold solves this problem completely, at the same time delivering a lustrous color that simply won't wear off and is unaffected by body heat or acids, or by external atmospheric conditions. Plastics are non-resonant, will not set up distorting vibrational sounds which would have an unpleasant effect on the user. The material is non-fragile, an essential quality required for such units. Yet, the parts are extremely lightweight. The complete equipment without the batteries weighs but a few ounces. Add to these the designability of plastics, permitting almost any shape and one finds a total number of outstanding vital physical properties in this plastic material.

THIS PREMIUM BOOSTS SALES

(*Continued from page 38*) stand excessive heat was quite a trick. At first, the handle was designed with an upper portion horizontally ridged, but the rubber, with very little difficulty, became loose. Rubber manufacturers, designers and molders experimenting together, devised a fork-like slotted head for the handle. Inside the rubber top a center projection was formed which slides into the slot while the two prongs of the handle fit on either side of this raised portion of the rubber. A special glue which adheres both to the plastic and to the rubber further guards against twisting out from the molded collar under which the rubber head fits.

Color combinations which awake a universal response were planned, the plastic exactly matching the sample shades selected. Six bright combinations, based on familiar national color insignias, blend with buff-colored rubber top—handle and band in contrasting shades.

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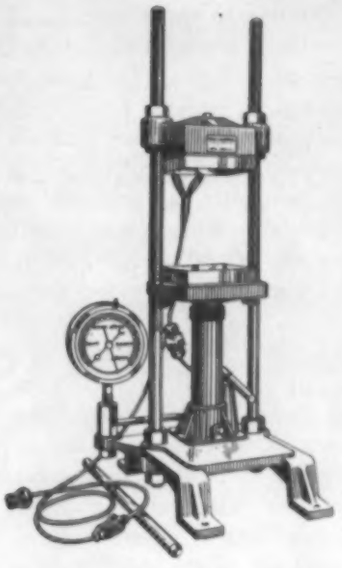

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(*Continued from page 23*) made in the opposite direction, from cooling to heating, the press is full of water which has to be discharged rapidly. Normal draining of the condensate is through a standard trap located adjacent to valve 11, which is open during the heating cycle. To insure rapid discharge of the cooling water, condensate bypass valve 12 was installed to give an unrestricted opening to the drain.

A small centrifugal pump was installed to insure adequate circulation. High velocity in the cooling water is maintained to provide rapid cooling. With this set-up, it is possible to extract 55,000 B.T.U.'s per minute from platens, polishing plates and sheets.

The four-cam controller, 4, performs several functions: The entire system is electrically interlocked, being started by the "start" button. A time-delay is provided, making it compulsory for the operator to hold in the start button for a predetermined time as a safety precaution. At the end of this "hold period," cam 1 locks in the electrical circuit. Cam 2 controls the opening and closing of the condensate bypass valve 12. This cam is adjustable, being locked in place when set for the proper cycle. Number 4 cam serves as a control for the three pilot valves 5, 6 and 7, which place the variable control pressure from the time-temperature controller on the diaphragm of the steam inlet or water outlet valves 8 and 10. This cam also automatically starts the water circulating pump at the beginning of the cooling cycle.

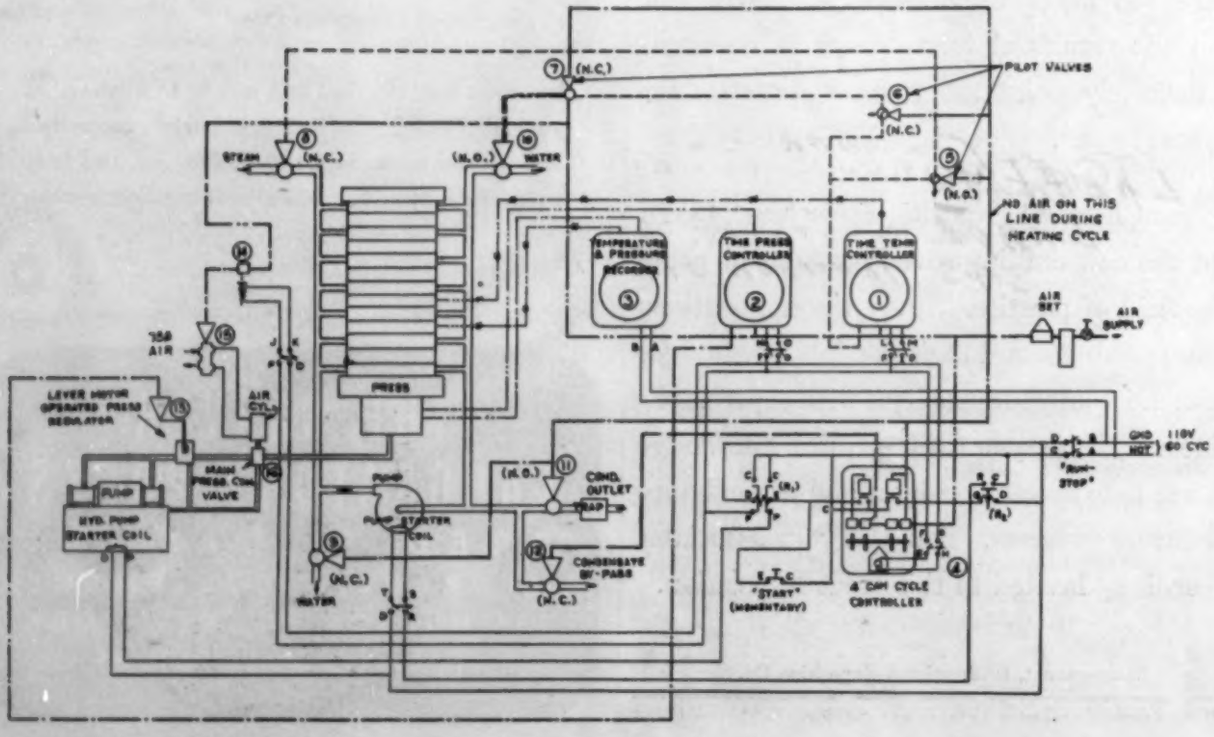
With the above description and accompanying control layout, the heating and cooling cycle may be followed quite readily.

The main press hydraulic operating valve 16, is controlled by means of a small pneumatic cylinder. The cylinder either opens the valve to apply hydraulic pressure to the press or opens the pump discharge to the tank. Shop air pressure is applied to the operating cylinder through the four-way valve 15. This latter valve is controlled by the solenoid valve 14, actuated by an air switch mounted in the cycle controller.

The variable pressure from the time-pressure controller is applied to diaphragm valve 13, which actuates a balanced piston type relief valve through a rack and pinion. This relief valve varies the hydraulic pressure to the press rams, and gives an accurately controlled varying pressure on the sheets.

On casual inspection, the control system may seem somewhat complicated, but the ease of changing from cycle to cycle and the insurance that one cycle will exactly duplicate another is ample justification for its installation. This control system, together with the rugged press, accurate platens, unique handling system and positive heating and cooling, makes possible the production of sheets of high and very uniform quality.

Temperature and pressure are accurately controlled in relation to time to insure a uniform product. The diagram, explained in the text, indicates the arrangement of cams and valves which, once set by hand, automatically control the operation of the press so that no variables exist between one cycle and another until the controls are reset



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PLASTICS IN AIRCRAFT

(Continued from page 44)

The importance of preventing instability by the use of low weight materials thus permitting increased bulk, is emphasized in the following quotation from the A-N-C Materials Handbook: "Practically all structural members such as beams and columns, particularly those made from *thin* material, are subject to failure through instability. The nature of aircraft structures is such that failures of this type are very likely to occur, and it is therefore necessary to recognize and provide for the possibility of such failures." Obviously, the use of lighter materials having *greater bulk* will greatly reduce the possibility of instability failures.

From Curve C, Fig. 1, it may be seen that materials having a low specific weight will have a considerably higher plate rigidity than aluminum alloys, weights being equal, and modulus being proportional to specific gravity. For example, a sheet of material whose elastic modulus is 5.2×10^6, and specific gravity is 1.4 (both one-half that of aluminum) would only need to weigh 63 percent as much as aluminum and be 26 percent thicker to give a plate rigidity equal to that of similarly dimensioned and supported plates. Thus in hull plating, wing skin, flooring, etc., a thicker sheet of lower weight material is more economical than any heavy high-strength material can be when a rigid, wrinkle-free sheet is desired. A comparison of various materials, when plate rigidity is the designing factor, is found in Column 4, Table II.

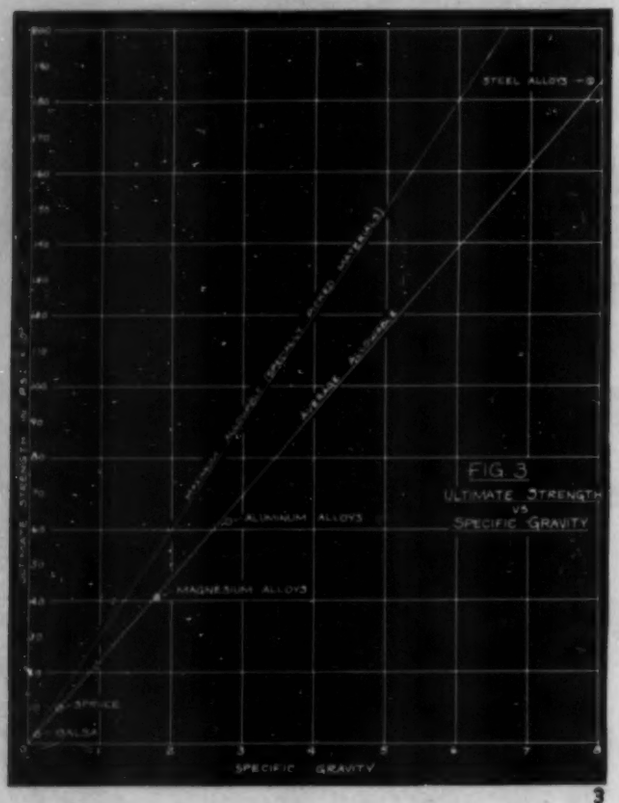

FIG. 3
ULTIMATE STRENGTH VS SPECIFIC GRAVITY

Curve D, Fig. 2, shows that in cases where box beams and monocoque or semi-monocoque fuselages are to be made, low weight materials will permit a reduction in weight if torsional deflection controls the design of the part, or else, they will provide greater torsional rigidity if the weight may be equal. High torsional rigidity is very important in modern high speed airplanes where all tendencies to flutter must be eliminated. In this regard low density materials usually have an added advantage due to their high damping properties. A comparison between torsional deflection of some materials is in Column 5, Table II.

Curve E, Fig. 2, indicates that a straight line relationship exists between the shear modulus and the specific gravity when shear deflections in stable plates are the designing factors. Due to the light gages used it is seldom that stable plates exist unless a large number of stiffening elements are used. In such cases complexity of design is increased.

Fig. 3 is presented merely to show a peculiar correlation between strength and weight throughout a wide range of specific gravity. It is apparent from the emphasis placed on instability in the discussion above that strength is *not* necessarily a prime design consideration since *average* developable stresses throughout a structure are only *a fraction* of the actual material strength. In the past strength-weight ratios have been overemphasized and the importance of bulk and high moduli of elasticity neglected.

Application of curves

Let us assume that a material having the following properties has been developed:

(1) Specific gravity = 1.0
(2) Elastic modulus = 2.5×10^6
(3) Shear modulus = 1.0×10^6
(4) Ultimate strength (tensile and compressive) = 15,000 p. s. i.
(5) Satisfactory forming properties
(6) Durability under all atmospheric conditions

Let us also assume that a present structure is to be redesigned so as to take full advantage of the lower specific gravity of our hypothetical material. This will probably mean a change from a multi-beam or

TABLE II. COMPARATIVE EFFICIENCIES OF VARIOUS MATERIALS BASED ON DURAL = 100

Material	Axial and Bending Deflection See Curve A, Fig. 1	Local Instability See Curve B, Fig. 1	Plate Rigidity See Curve C, Fig. 1	Torsional Deflection of Monocoque Shells See Curve D, Fig. 2	Shear Deflection in Stable Webs and Thick Walled Tubes See Curve E, Fig. 2
Load-carrying efficiency for equal weights of various materials, Dural = 100%					
	percent	percent	percent	percent	percent
Stainless steel	88	31	11	12	93
Magnesium	97	149	238	240	97
Spruce	81	508	3,450	2,700	70
Weight efficiency for equal load carrying ability of various materials, Dural = 100%					
	percent	percent	percent	percent	percent
Stainless steel	88	56	48	49	93
Magnesium	97	123	133	134	97
Spruce	81	225	325	300	70
Minimum weight for equal load carrying ability of various materials, Dural = 100					
Stainless steel	114	179	208	204	108
Magnesium	103	81	75	75	103
Spruce	124	44	31	33	143

These data are for similarly designed and proportioned structures where stiffener spacings, stiffener sections, panel widths and length, disposition of loads, etc., remain constant and are approximations, particularly for spruce because of its nonisotropic nature. The minimum weight values are the reciprocals of the weight efficiency values. Values of moduli and specific gravity of reinforced plastics vary too widely to include these materials here.

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longeron structure with partially stressed skin to a semi-monocoque or even a full monocoque structure. Curves B, C, and D, will then govern the design of most parts fabricated from our new material. Referring to Curve B, the weight efficiency as compared to aluminum alloys will be the specific gravity indicated on Curve B for a material having an E of 2.5×10^6, divided by the actual specific gravity of the material at the same value of E, or $1.35/1.0 \times 100 = 135$ percent. For the same stiffener spacings, rib spacings, etc., the same weight of structure will carry $(1.35/1.00)^2$ or 182 percent of the load that aluminum alloy will carry. On the other hand the structure need only weigh $100/135 = .745$ as much as the aluminum structure to carry the same load. If structural simplicity is desired rather than either increased load-carrying ability or a decreased weight, greater spacing may be used between the stiffening elements and many parts eliminated from the structure. Naturally this will tend to increase the rate of production and decrease costs.

TABLE III

VALUES USED FOR *E*, *G*, AND SPECIFIC GRAVITY FOR MATERIALS COMPARED IN TABLE II

	Dural	Stainless Steel	Magnesium	Spruce
$E \times 10^6$	10.5	26.0	6.5	1.3
$G \times 10^6$	3.9	10.0	2.4	0.6
Specific gravity	2.8	7.85	1.80	0.43
Wt./cu. in.	0.101	0.283	0.065	0.0155

In a similar manner, the weight efficiency will be 172 percent and the load carrying efficiency 508 percent from a standpoint of plate rigidity and 180 percent and 583 percent for torsional rigidity, or weights could be cut to .58 and .56 of their present values. This procedure was used in calculating the values in Table II. While it must be realized that these values represent *optimum* conditions, they do serve to indicate the possibilities inherent in light materials. Detailed design investigations will show that an equally light, much simpler structure can be designed without stressing any part of the material up to its ultimate strength of 15,000 p. s. i. A material having a specific gravity lower than that of our hypothetical material would be even more satisfactory and efficient because thicker, bulkier sections could be used.

JOSEFF, OF HOLLYWOOD

(*Continued from page 33*) motif and subtle beauty of finish achieved in Joseff's designs.

Black and white injection molded medallions in circular or oval metal frames, are authentic replicas of antique jewelry and have all the rare charm of hand-carved ivory and ebony. Flower pins in colors to complement any frock—some smooth and lustrous, some speckled with gold dust, others in white with a dull rough finish of alabaster—have gold or silver colored metal centers firmly attached by special rivets screwed in individually by hand.

The strange part of it all is that Joseff uses the same plastics and the same methods, in many instances, as those by which trinkets are turned out for mass markets. The vast difference and the peculiar characteristics which raise his jewelry so far above some of that seen on display is largely a matter of intelligent handling and design. His leaves and flower petals are not paper-thin; he doesn't push a metal pin or clip into the back hoping it will hold in place until the piece gets off the retailer's counter. Instead, both the plastic part and the metal fastening are designed for permanence and satisfaction.

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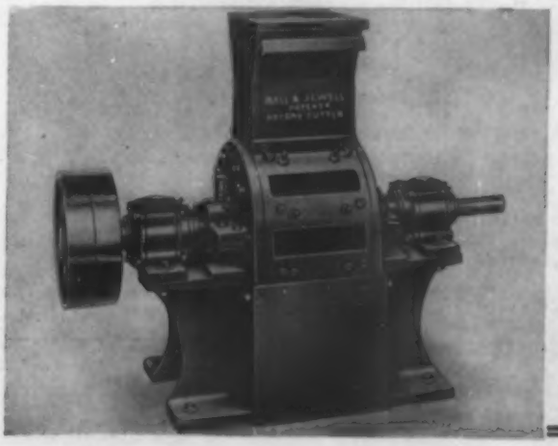

● Redesigned and molded of plastics the Wirl-O-Wash replaces the old glass eye cup. Four angular fins molded in the cup swirl the lotion or water gently over the eye-ball when pressure is applied to the bulb, removing any dust or foreign matter.
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L'AGE DES PLASTIQUES

(*Continued from page 35*) in nature, aren't in such a hurry. The cornflower doesn't just chuck its own shape because it takes less effort to be a daisy in these days of mass-production. What I am getting at is that a reputation for artistry in making plastic flowers, or anything else, takes more than the raw materials and the ability to say, "Quick, quick, quick!"

Dress ornaments, and more particularly jewelry, highlight the costume. Flat, uninteresting ornaments are low-lights that kill the effectiveness of the gown, however good the material. It behooves the creators of jewelry from new materials to study real jewels, then try to simulate their mood rather than their actual form and cutting. Real jewels depend upon a life and sparkle within their own materials to give a quick little mysterious change, and so absorb the interest of the eye.

Lacking the actual change in color within the material, I observed that the French manufacturers are employing these techniques to overcome the handicap:

1. The design itself is kept simple, so that the material looks dignified. Strong line and color make up for lack of depth and change in the plastic itself.

2. When two or more colors of plastic are used in the same ornament, they are usually kept within a close color range—coffee-color is used with brown; red-orange and yellow-orange with cream. The eye associates these and seems to see one very rich color.

3. They fleck one color just a little with a closely related tone. The red of the chain was flecked with stony cream which seemed to make it into a completely different and much more alive material than the solid red would have been.

(*Please turn to next page*)

View from garden of the Paris exhibition shows a series of groups of manufactured products, each centered by a graphic chart explaining the chemical origin of the plastic used for that entire group

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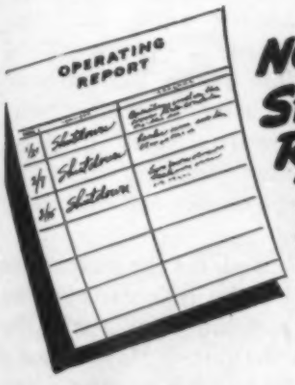

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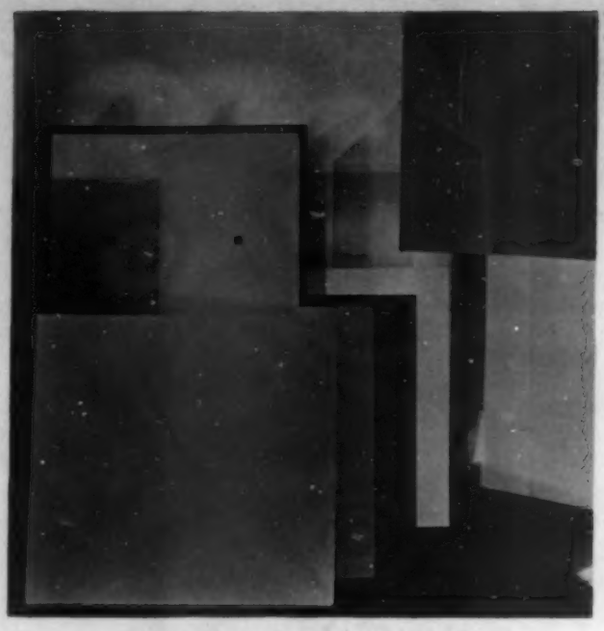

Huge unworked sheets of plastic several feet square, arranged at the entrance of the main hall, illustrate the wide range of colors and tactile quality of the materials

4. They establish a main color theme in a piece, and use other colors, not just to liven up the piece and take the eye off center, but to make that main color seem to sparkle, and to bring the eye always back to it.

5. They use for costume accessories colors of plastics that aren't likely to be seen every day on gear shifts and toothbrushes. By using unfamiliar colors, they preserve the idea that the ornament is "precious." A tremendous number of American women buy ten-cent-store plastic jewlry. And a tremendous number more pick a piece up because they are attracted by the color, and put it down because they can't feel very dressed up by a "jewel" which could have been sliced off the handle of their favorite paring knife.

I don't want to point now, but a lot of the inexpensive plastic jewelry we make in America isn't put together as well as it should be. It sometimes looks as if the "gem" had been thrown at the setting, landed some place near it, and if it stuck, was left at that. The French distinguish themselves by keeping metal bands firm and straight when they must be visible at all. They fit the retaining pieces firmly, and design them to become integral with the more important motif of the piece. It is surprising how much more of a jewel-like quality a plastic ornament assumes by careful setting.

Finally, even the woman who pays only ten cents for her jewel, hopes that it will add something to her own glamor. Understanding this romanticism is basic to the French success in designing jewelry for countesses and for cooks. The French throw out all rules when they have a really new idea for making an ornament that is visually interesting. They dare to be original, because they are imaginative enough to realize that a woman would like to feel that she herself is original and new and clever because she puts on a new ornament.

TECHNOLOGY DEPT.

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MODERN PLASTICS

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Foreword

IN PLANNING AND MAKEUP, THIS OCTOBER ISSUE DIFFERS FROM THAT OF former years in that each descriptive article of plastic materials, so far as possible, follows a pre-arranged pattern for easy reference. The chemical set-up, recent developments, typical uses, forms available, methods of handling, and trade names of each product are logically presented so that the search for particular information on any subject, especially upon any type of plastic material, is considerably shortened and simplified. In that respect, this becomes the first reference book on the subject of organic plastics which has ever been printed along these lines.

It should be remembered, too, that each of these articles has been written upon the authority of vast personal experience of the individual authors backed by the experiences and resources of the companies they represent. In no manner could a more complete and authoritative book be published. Nor in any other single source is so much dependable information available to those whose interest in plastics and their fabrication is vital to their production plans.

Reference to the Table of Contents (pages 3–4) will quickly point to the location of the items of interest and the Directory of Trade Names (pages 447–448) will reveal the source of materials desired. Manufacturers' names and addresses can be determined quickly by reference to pages 449–452. The Plastics Properties Chart, which has proved invaluable to manufacturers and designers for comparing the physical characteristics of various materials, appears opposite page 186, completely revised.

In presenting this fourth annual Catalog-Directory number, we gratefully acknowledge the time and effort so unselfishly given by the authors. We also thank those in the industry who have given so freely of photographs and data which in some instances could not be elsewhere acknowledged.

We are grateful to the Plastics Department of the General Electric Co., the Parkwood Corp., and the Mahogany Association, for their cooperation in developing and making possible the use of Parkwood-Textolite plastic covers for this issue. To our knowledge, this is the first time that such use has ever been made of this laminated plastic material.

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